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SMALL ARC LAMPS.

In the Digest will be found a notice of a type of arc lamp of small candle-power which is being introduced in Germany, and may perhaps be worth investigating on this side of the water. The lamps, as will be seen, are of about 70 cp, and it is claimed that they will give twice as much illumination as incandescent lamps for the same expenditure of electrical energy. As such lamps would only be suitable for interior illumination, a difficulty at once presents itself in the fact that the use of globes necessary to diffuse the light would nullify the superior efficiency claimed, it having been found that globes used with ordinary arcs for this purpose absorb from 40 to 60 per cent. of the light of the bare arc. There are, however, places where such arcs could be used with clear glass globes absorbing only about 10 per cent. of the light, as in warehouses or in storerooms where a perfectly clear light is desirable, but for which purpose the ordinary arc would have too great an intensity.

WIRE GAUGE FORMULAS.

In another column Dr. Cary T. Hutchinson gives several formulas by means of which the resistance and weight of copper wires and the sectional area of any wire may be found when the only data at hand are the Brown & Sharp gauge numbers. While the values are only approximate, two of the formulas are sufficiently accurate for any practical use, and the error included in the third will also be frequently negligible. The chief value of the formulas, however, is due to the remarkably simple manner in which they may be solved by means of an ordinary logarithmic slide rule. All that is necessary is to set the rule to the arithmetical value of the simple fraction given, when the area, weight or resistance may be directly read off on the reverse side. As the slide rule is now entering into almost universal use, the convenience of the method devised by Dr. Hutchinson is obvious, particularly as the simplicity of the fractions is such that they can easily be committed to memory, thus rendering one independent, to a great extent, of wire tables.

TREATMENT OF CROSS TIES AND LINE POLES.

In our report of the Montreal Convention will be found an abstract of the report of Mr. N. W. L. Brown on cross ties and line poles, which will well repay the attention of those who use this material extensively. It is shown that the life of ties and poles may be lengthened to a surprising extent if creosoted—an instance being quoted where, at the end of 35 years, telegraph poles thus treated were still in good condition. It has, of course, been long known that wood may be preserved by treatment with various substances but in few instances has advantage been taken of the knowledge in the electrical industry, doubtless for the reason that in all of its earlier stages almost everything was sacrificed to considerations of first cost. According to Mr. Brown, the cost of treatment with creosote is comparatively small, and as the necessary plant is not expensive, a recognition of the desirability of treated ties and poles on the part of users would probably result in their being easily procurable in the market, and at an advance of price over ordinary material that would not assume any serious proportion with respect to questions of first cost or maintenance.

PROFESSORS AS PRACTITIONERS.

Our English contemporary, the London *Electrician*, in discussing the subject of technical professors, comes to the conclusion that in this branch of teaching old age should give way to youth. "For in technics, even more than in pure science, superfluous lags the vet-

eran on the stage." This verdict is sufficiently obvious to meet the approbation of all, even of the veteran himself, but the same cannot be said of its commendation as "a wholesome condition" of the policy of some English technical schools in requiring the holders of chairs to remain in active professional practice. The objection to this policy is two-fold. In the first place, experience in this country has shown that it leads in many cases to the school suffering severely, as the professional work undertaken by the teacher cannot but conflict at times with his school work, and the commercial conditions intervening almost necessarily cause the latter to bear any sacrifice called for. On the other hand, there seems to be little in common in the quality of mind required to make a successful teacher and that necessary in a successful engineer, and as a consequence the competent engineer is little likely to be also a competent teacher. The policy referred to seems to result from the idea, now happily being relegated to the rear, that the function of a technical school is to turn out full-fledged practitioners. When the real object of such a school is recognized to consist in the teaching of principles and the cultivation of the mental powers as a foundation for subsequent growth of the technical judgment which constitutes the engineer, the policy referred to will cease to be applied.

THE MONTREAL STREET RAILWAY CONVENTION.

The Convention at Montreal, last week, of the American Street Railway Association excelled by far any of the previous gatherings of this body, and may be said to have broken the record in almost every respect as compared with the annual meetings of other electrical organizations—for we believe that the American Street Railway Association may now be fairly classed as an electrical body. The attendance was surprisingly large, being estimated at little less than 1,000. The interest in the transaction of business was most gratifying, and the exhibition annex, notwithstanding customs complications, was very complete in all branches of the art. It cannot be said, however, that the professional feature of the meeting was correspondingly successful, though this remark is rather true with respect to the number of papers read and their discussion than applicable to their character. The report of Mr. N. W. L. Brown on cross-ties and poles is valuable, both from the data which it contained and from the convincing manner in which the merits of the creosoting process as applied to line and ground timber are brought out. In view of the figures there given, no one using cross-ties and poles extensively can afford to neglect a careful consideration of the value of treated material, which would appear to be desirable for use from the commercial standpoint even if the cost delivered greatly exceeds the figures given in the report, which seem to be exceptionally favorable. The paper by Mr. Wessels on air-brakes was a timely one, and praiseworthy from the fact that it lays stress upon the necessity of intelligence on the part of motormen entrusted with the handling of air-brakes, and care in their maintenance. It is too often the case that in introducing new apparatus such points are carefully avoided for fear of exciting prejudice, though the result will, in almost every case, prove that such a policy is far from being wise. We believe, with Mr. Wessels, that the day of the power brake is near at hand, but furthermore that the desirability of more intelligence on the part of the motorman should be recognized independently of this question. While the electric railway motor will admit of much abuse, its more intelligent management would result in considerable saving in wear and tear aside from reducing expenditures for direct damage, so that the introduction of power brakes will exert a beneficial influence in more than one direction. As to the measures brought before the Convention with a view to enlarging the scope of the Association, it is to be regretted that the question relating to the deficit in the treasury intervened to prevent final action. In one respect, however, the delay thus occasioned may result beneficially by giving time for the consideration of the advisability of extending the scope still further than was proposed this year. For example, the bureau recommended to be established in order to consider all matters relating to patents could very easily be enlarged to also perform the functions of a central office for the collection and distribution of technical information to the members of the Association, somewhat after the plan suggested by Mr. E. A. Merrill in our issue of last week. Above all, the delay leaves in a favorable position the question as to whether the Association should not so enlarge its scope as to include all applications of electric traction, and assume the name of the American Electric Railway Association. In our issue of last week a number of reasons were offered as to the desirability of this important step, and we believe that the matter is one which during the present year should occupy the serious attention of the executive committee preparatory to the preparation of its report to the coming St. Louis Convention on the general subject of scope.

An Important Electric Railway Damage Decision.

On Oct. 14 the New Jersey Supreme Court, at Trenton, gave a decision in favor of the plaintiffs in a suit against a street railway company for damage from an electric shock due to improper bonding of rails. The suit was brought by Samuel M. Bennett and Charles S. Cooper against the Trenton Passenger Railway Company. On May 27, 1894, while the plaintiffs were out driving behind a valuable horse, the animal happened to get his hind legs on a rail and received a shock which caused him to become unmanageable; both men as a consequence were thrown out and Mr. Bennett was severely injured.

The testimony showed that the rails were bonded with a single No. 2 iron wire, the supplementary return being No. 4 iron wire; the former is equal to a No. 9 copper wire.

Measurements made in May, 1895, for difference of potential between rail and ground four feet away showed under the normal operation of the road, at times, one and one half volts. The inference was that with the conditions as they were at the time the horse was shocked, there could have been a difference of potential sufficient to cause the accident. Experiments made on horses showed that they jumped at 4.5 volts, direct current. Witnesses were produced to prove that at several other times horses had been shocked and knocked down at this same place, but the Court overruled this testimony.

Prof. Moore, of Princeton College, testified that he had measured the resistance of the track and found it .62 ohm per mile. This he considered very low. In rebuttal Mr. Woodbridge, of New York, testified that he had made track measurements, and found .03 ohm, which he considered rather high. Prof. Moore's figure, according to an expert for the plaintiff, is equivalent to a drop of 250 volts per mile of track with 400 amperes. Prof. Moore also produced a model to prove that it was easier to get a shock on a dry day than on a wet day. He had a tin pan connected to one side of a magneto, and a piece of iron connected to the other side, resting on some dry sand in the pan. When jurymen touched the pan and iron they received a shock, but on wetting the sand the shock ceased. Prof. Moore refused to submit to a new set of conditions, as proposed by the experts for the plaintiffs, and he was duly scored by counsel in summing up, the experiment as he arranged it being declared to be comparable to a horse having one foot on the rail and the other on the trolley wire. The Judge charged the jury as to the law in the case, and after being out several hours, they brought in a verdict in favor of the plaintiffs, naming damages.

Death of Eugene Langen.

Mr. Eugene Langen, one of the noted millionaires of Cologne, and a director of the Otto Gas Engine Works, of Philadelphia, suddenly died on the 2d inst., of heart failure, at his country seat at Elsdorf, not far from Cologne, Germany. Mr. Langen was one of the largest beet sugar manufacturers in the world, acquiring by that business about $20,000,000 in American money. Beside this he had other large interests, and was a director of the Gas Motoren Fabrik Deutz the largest of its kind in Germany. He had many decorations conferred upon him for his ingenuity and enterprise, one being from Emperor William I. He was only once in the United States, in 1894, when the firm of Schleicher, Schumm & Co. ceased to exist, and the Otto Gas Engine Works were incorporated. He was about 60 years old and leaves a family of 12 children, one of whom, Mr. Gustave Langen, is president of the above American firm.

The Thomson-Houston Arc Regulator Suit.

The United States Circuit Court of Appeal at Chicago has sustained the decision of Judge Grosscup, rendered early in the year, declaring void the Thomson-Houston brush shifting patent for arc current regulation.

In addition to the defense which was most strongly urged—namely, that of the first Thomson-Houston patent, No. 223,659, which showed substantially the same device as that of the later patent, No. 238,315, upon which suit was brought—the invention of Maxim of an automatic current regulator for dynamo-electric machines, which as applied to separately excited dynamos running incandescent lamps in multiple arc, was also urged as an anticipation of the patent in suit, and the opinion of the court was that this defense could alone be considered adequate to defeat the broad claim of Thomson and Houston for automatic brush-shifting current-regulation. Referring to the fact that the current regulator has gone into extensive use, the court says it is met with the usual inquiry: "Why, if there is no invention in it did not somebody else make the same or like improvement upon the earlier construction?" To this it is replied that it would be enough to answer that if done by anybody else than Thomson and Houston, or their assignee, it would have been an infringement of the first patent. However, the court adds, it *was* done by Maxim, in whose patent, No. 228,543, the controller magnet is placed in the main circuit, and though the collector brushes moved thereby are not upon the commutator of the dynamo from which the current of that circuit is derived, but upon a second dynamo employed for the purpose of exciting the field of the first, the effect of the adjustment being to maintain a constant field and thereby to establish the desired constancy of current, the employment of the second dynamo does not disguise the fact of automatic regulation of the commutator brushes in the manner and by the means of the Thomson-Houston patents.

The court concludes that if the patent now in suit should be upheld it would be in its opinion an unwarrantable prolongation of the just monopoly conferred by the first patent, which, notwithstanding the strenuous efforts made to minimize it, is deemed to have been of great merit and entitled to liberal construction.

The Ohio Electric Light Association.

The annual meeting of the Ohio Electric Light Association was held at Piqua, Ohio, Oct. 8. This was its first annual meeting, the Association having been organized only in May last, and the attendance was most gratifying under the circumstances. The secretary was able to report that the Association had on its membership roll nearly 50 per cent. of all the central-station companies operating in the State. The following officers, who had been chosen at the preliminary meeting, were re-elected for the ensuing year:

President, A. W. Field, Columbus Edison Electric Light Company; vice-president, Wm. C. Hedges, Mansfield Electric Light & Power Company; secretary and treasurer, Samuel Scovil, Cleveland Electric Illuminating Company. Executive Committee: B. P. Holmes, Youngstown Electric Light Company, H. K. Wood, Piqua Electric Company and L. C. Newsom, Columbus Electric Light & Power Company.

The constitution of the Association as originally adopted, provided for active, associate and honorary members, but at the Piqua meeting amendments were adopted confining the membership to two classes, active and honorary members. Under the head of associate members, the original intention was to afford representation in the Association to any manufacturer of electrical apparatus or supplies. Under the constitution as amended, manufacturing companies cannot now obtain representation in the Association.

A resolution was unanimously adopted, reciting that as certain manufacturers of electrical apparatus have in the past, and are at this time attempting to secure franchises for the installation of electric lighting plants in certain cities of this State, and as these franchises are not sought for the purpose of making a legitimate investment, inasmuch as the demand for electric services in these towns is not sufficient to support an additional company, but is rather for the purpose of compelling the existing companies to become customers of these manufacturing companies, the association therefore puts itself on record as condemning such business methods, as being neither more nor less than blackmail, and that such methods justify the Association in requesting each of its members to refuse to purchase of such companies any apparatus whatsoever, if they thus continue their piratical attacks upon the invested capital which the Association represents.

At the morning session of the Association, Oct. 9, Mr. Caryl D. Haskins, of the General Electric Company, read an interesting paper on the use of meters and transformers, which the secretary was directed to have printed and distributed to the members of the Association.

Patent Abuses.

BY J. E. KEELYN.

No less than 90 per cent. of the patents issued on telephonic apparatus are for simple improvements in the art, and not entitled to the dignity of invention. There are not more than ten in one hundred of the patents that a good mechanic, familiar with the art of telephony, could not have devised. It is quite easy to believe that of these ten about two thirds are simple adaptations of old devices to the new art. Of the balance about one half are not patented in the name of the real inventor, and if the 2 per cent. remaining are, it is safe to assume that no considerable financial reward accrues to the inventor in more than one case out of two. This assumption resolves itself into a statement that only one invention in one hundred brings financial success to the real inventor.

Searching this we find matter for serious thought. If 90 per cent. of the patents are not real inventions, then that percentage of legal barriers stands in the way of progress in the art. Innumerable device patents are bought up by large concerns, or obtained at their instance, at a small outlay, and these patents are used to monopolize one or another branch of the art.

The intelligence or gift of the inventor and the merit of the invention amount to little in these days as against the aggression of capital in the hands of most financial managers. The man who in a private transaction would ordinarily disdain being unjust, in corporate business methods directs with vigorous wrath a legal battle which has for its end the dishonest monopoly of a branch of an art, or the annihilation of the monopoly of another.

The extent to which the practice of imposing on the patent office is carried, is little understood. Attention need only be called to the fact that a number of large concerns employ professional patentees. These men are continually presented with the ideas or inventions of others in an embryotic state, and frequently in completed form ready for the application. The professional patentee makes oath that he is the original inventor, full knowing that the invention was that of another, the heads or officers being also fully aware of the practice. The real inventor may or may not be paid a small stipend. He may silently allow the perjury rather than "lose his job." There is one well-known "professional patentee," to whom the by-words "I've had a drawing of that for some time" have been applied, because of his "absent-minded" exclamations. He has claimed so many things without opposition that it is now "second-nature" with him to want it all.

Every conceivable method of accomplishing mechanically or electrically this or that result is covered by a patent or patents on devices to that end. A mechanic of ordinary intelligence after a week's time in an electrical manufactory suggests to his superior a better design than the one in use. He is told that his suggested method is patented. Surprised, he suggests another way, and learns that this way is also patented, and so on through every new suggestion. In the writer's factory at least five hundred suggestions of improvements in one way or another have been offered by the ordinary workmen, and found upon examination already subjected to the dignity of patent claims, usually by a professional patentee. Of course, this fact would indicate absence of the elements of invention and that the patents were of little legal value, if litigated.

Another Turbine Plant for Niagara.

The Niagara Falls Hydraulic Power & Manufacturing Company has recently contracted with James Leffel & Company, of Springfield, O., for four double discharge horizontal shaft water wheels, to be of 8,000-hp capacity under a maximum head of 218 feet, which is claimed to be by far the highest head under which turbines of large capacity have thus far been applied. These wheels will drive direct-connected electrical generators. The same company has already several of this type of wheel, each of 1,200 hp, in operation in the Niagara Cliff Paper Company Mills. It is also building four cascade wheels to be operated under 720 feet head; in this case part of the power will be electrically transmitted from generators connected directly to the wheel shaft. The cascade wheel is essentially different in construction and operation from the turbine, being in principle an impulse and reaction wheel.

Approximate Formulas for American Wire Gauge.

BY CARY T. HUTCHINSON, PH.D.

The following approximate formulas for resistance, weight and area of wires, based on the American or Brown & Sharpe wire gauge, have been found very convenient where no table is at hand.

Let

R = the resistance per 1,000 feet of wire.
W = the weight per 1,000 feet of wire.
$c.\ m.$ = area in circular mils.
N = gauge number (No. 0, $N=0$; No. 00, $N=-1$, etc.).

Then

$$R=10^{\frac{N-10}{10}}$$
$$W=10^{\frac{25-N}{10}}$$
$$c.\ m.=10^{\frac{50-N}{10}}$$

Or, calling x the antilogarithm of a in the formula, $x=10^a$.

$$R=\text{antilog}\ \frac{N-10}{10}$$
$$W=\text{antilog}\ \frac{25-N}{10}$$
$$c.\ m.=\text{antilog}\ \frac{50-N}{10}$$

The error in the first two formulas is within 2 per cent. for all sizes up to No. 20. The third formula is less accurate, the error ranging from 6 per cent. for No. 0000 to 2 per cent. for No. 20. The resistance is for 75 degrees F.

The calculation is extremely simple when a slide rule with a logarithmic scale on the back is used; the index on the back is set to the mantissa of the logarithm, found by the formula; the resistance is then shown on the front scale. Care must be paid to characteristics and negative logarithms.

The Fatal Accident at Great Barrington.

Mr. Ralph W. Pope, secretary of the American Institute of Electrical Engineers, and oldest surviving brother of the late Franklin Leonard Pope, who was killed by electricity at his Great Barrington home on Sunday last, returned to New York on Friday.

Mr. Pope, like his brother, has had a long and varied electrical experience, and from the time of his arrival at Great Barrington on Monday, up to his departure on Thursday, has made a daily study of every condition existing at the spot where his brother died. He also carefully questioned every person who had any knowledge of the facts, as no official examination was made beyond the autopsy on Wednesday. Mr. Pope places great confidence in the careful examination of the converters, wires, etc., personally conducted by Edward Weston, Wm. Stanley and Geo. A. Hamilton, than whom he says no higher authority could be desired. These gentlemen have a report in preparation which will soon be published.

Mr. Pope's story of the occurrence shows that his brother was apparently the victim of an accident, solely due to the fact that in order to test the lines and observe the working of the plant, he had permitted the location in his cellar of a converter, which necessitated the leading in of the primary wires of the system, carrying a normal voltage of 2,100. These wires were brought in at the north cellar window at a point distant about two feet from the transformer. There was a twisted joint in each wire about midway between the entrance of the primaries and the converter to which they were connected. One of the joints stuck up, and although both were supposed to be covered with so-called insulating tape, it is quite possible that one of the points of these joints was bare, owing to the difficulty of covering such a joint unless extreme care is used. The tape from these joints had been removed after the accident and the wire adjacent to the joints themselves broken on one side and cut with pliers on the other. The joints were taken out and were found on the floor behind the cold air box on Thursday. One of the facts which an early examination did not account for, was that the main scar on the right hand gave evidence of a physical injury, being a deep, ragged scratch, as well as a scar from the electrical burn. The point of either of these joints was well calculated to produce such an injury. The other minor burns, one on the knuckle and one on the back tip of the forefinger, might have been made either before or after the more serious injury.

As he approached the transformer with the lighted lamp in his left hand to look at the wires, it is possible that he first encountered a strong draft from the open cellar window, the sash of which was suspended by hinges, and according to the statement of Mr. Bell, who was familiar with the cellar, had been unfastened for some time, and would, therefore, swing more or less with the wind. It was necessary in order to secure it to push the window back and at the same time turn the button on the end of the sash with the right hand. Having thus closed the window the withdrawal of the hand apparently brought it into contact with one of the twisted joints already described, by which his body was placed in the primary circuit, the current entering his hand, passing through his body, and entering the concrete floor through the soles of his shoes. It is quite likely that the flame of the kerosene lamp may have been blown out before Mr. Pope had closed the window, in which case the liability to an accident of this kind was increased, or some trivial incident may have distracted his attention for a moment.

It was a rainy day and he had walked to and from church, a distance of about half a mile, and had also strolled about his yard, so that his shoes were doubtless damp. The wet branches of trees swayed by the wind had also caused grounds on the main line through the village, the consequent flashing having been quite generally noticed that evening. Had he stood closely enough to the window to close and fasten it, he must have stood on a portion of the concrete floor, dampened by the dripping of water from the wires which had no "water-drip" outside.

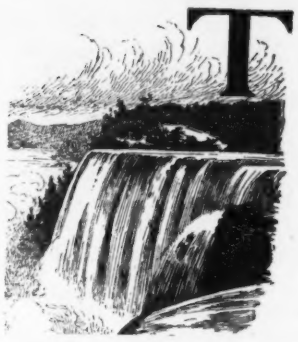
Mr. Weston is of the opinion that the position of the hand after closing the window was at such an angle with the wire that the existing burn could not have been made by the point, although no other theory as to the raggedness of the injury has been advanced. It is evident that no attempt was made to handle the wires in any manner, all the burns being on the back of the hand.

Sigmund Schuckert.

In our issue of last week we printed a biographical notice of the late Sigmund Schuckert, and are enabled to present herewith a portrait of this eminent pioneer in the German electrical industry. The great firm at Nuremburg, built up by his efforts, is now known over the entire world, but it is with the earlier days of electric lighting that his name is most indelibly associated. He is one of the several who first placed the industry on a firm basis by contributions to design and engineering, in those early days being as great a force in the pioneer development of the art as he subsequently became in its commercial exploitation.

Sigmund Schuckert.

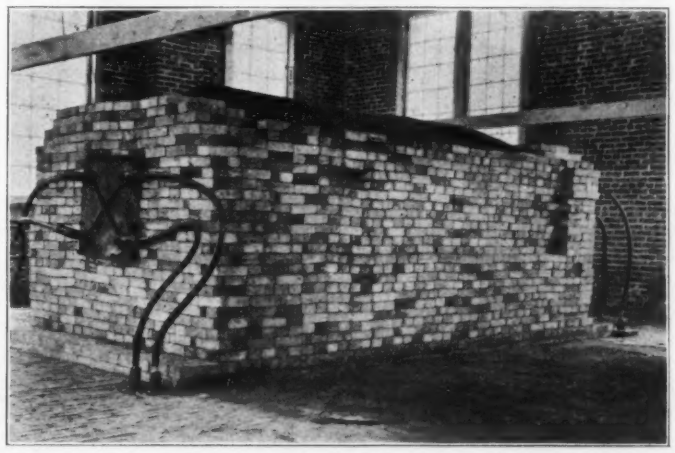
The Carborundum Plant at Niagara.



THE plant of the Carborundum Company, at Niagara Falls, which was started on Saturday, Oct. 19, may properly be considered unequalled for concentrated power-consumption and novelty of product. One thousand horse-power of electrical energy, generated by the great dynamos of the Niagara Power Company, were then turned into the reducing furnaces described below, and the manufacture on a large scale begun of carbide of silicon, known to commerce as carborundum, by the process invented by Mr. E. G. Acheson in 1891.

The various buildings and apartments of the carborundum plant are admirably arranged for the economical handling and manipulation of the materials. The stock building, into which are received the crude materials, is provided with a railway track connecting with the Niagara Junction Railway, on which the loaded cars are conveyed to the various bins or compartments provided for the reception of the crude materials, which consist of coke from the Pennsylvania bituminous coal fields, white sand from Ohio, salt from Syracuse, and sawdust from the mills of Tonawanda. Conveniently arranged in relation to the storage bins of crude materials, is a most complete grinding, grading and mixing plant, into which the coke, as it comes from the cars, is introduced and ground and sifted into assorted sized grains and conveyed into bins ; from the latter it is drawn and mixed, in proper proportions, with measured quantities of sand, salt and sawdust, and then delivered into a bin provided for the finished mixture. The work is done by automatic machinery at the least expenditure of manual labor.

THE CARBORUNDUM WORKS.



A REDUCING FURNACE.

The four crude materials having been thus thoroughly mixed, the product is conveyed to the electrical furnaces, situated in an adjoining building, and which have the appearance of rough and apparently crude oblong brick boxes, made without cement, mortar or other binding materials. Provision is made for five of these boxes, which extend down one side of the large spacious building, each of them measuring about 15 feet in length by 7 feet in width and the same in height. In the centre of each end is placed a large bronze plate and these are connected by means of four large copper cables to massive copper bars extending under the floor at either end of the furnaces. Connecting with the inner surfaces of the bronze plates are 120 carbon rods, 60 to each plate. These carbon rods are three inches in diameter and something over two feet in length, and are so placed as to pass through the end walls of the brick box or furnace, projecting into the interior and toward each other, thus constituting the terminals. Into this rectangular brick box the mixture that has been prepared in the stock room is introduced, about ten tons constituting a charge, and through the centre of the mass of mixed materials is placed a core or cylinder of granules of crushed coke extending from the carbon rods at one end of the furnace to those at the other end, a perfect electrical connection through the furnace, by means of the bronze plates, carbon rods and the core, being thus made.

The furnace, as now described, is prepared for the turning on of the electrical current, and this is provided for and controlled in the adjoining building, which was specially constructed for the transforming apparatus used in reducing the high-pressure current as received from the dynamos of the Niagara Power Company to the low-pressure current used in the electric furnaces. Located in the same building is the regulating apparatus used in controlling the current as it passes to the furnaces. The transformer and regulator contained in this building are said to be the largest that have ever been built, and the regulator absolutely controlling a current of 1,000 hp.

When everything has been properly prepared current is turned into the granular core, already referred to, and kept on for 24 consecutive hours. All of the vast amount of energy being transmitted to the core—21 inches in diameter and about 9 feet long—and within its mass, it is converted or transformed from electrical to heat energy.

A short time, perhaps two hours, after the turning on of the current, gases begin to escape through the crevices of the brick walls of the furnace, and, being ignited, burn with a lambent blue flame. As the process continues the outer walls and top of the mass in the furnace slowly rises in temperature through the transmission of the intense heat from the core, the entire top of the mass being red-hot in about 12 hours. After the current has remained on for the period of 24 hours, or until such time as the workman in charge recognizes as sufficient, it is switched off in the transformer building, the flexible cables are disconnected from the bronze plates and others are connected with the plates of the next furnace in the series of five, which in turn are carried through the same operation.

One end of the first furnace is then removed and a cross-section through its centre exposed, thus permitting of a ready inspection of the results of the operation. In the centre is the granular core, in the same position in which it was originally placed, but it is now purified of all foreign substances. It is now pure carbon and has lost about one fourth of its weight; this loss represents the volatilized impurities. The presence of grains of graphite disseminated throughout its mass indicate that its temperature must have been near 7,000 degrees F.—the point of graphitic formation. Surrounding the core in the form of a cylinder is a beautiful crystalline formation, the crystals being constructed on lines radiating from the centre. The crystals in immediate contact with the core are looped or built together into one concrete mass; as the distance from the core is increased, the size of the crystals diminishes rapidly, until at about 15 inches all crystallization ceases and an amorphous material is encountered, of a whitish gray color, for a distance of two inches, when a sudden change occurs to a black mass composed of the original mixture, now held together in a cemented state by the fusion of the salt.

The crystalline and amorphous material, lying between the core and the outer black mass, is carbide of silicon, being composed of equal atoms of carbon and silicon. About two tons of carborundum is produced in one furnace run, and to prepare it for the market it is first passed under heavy iron rolls for the purpose of crushing apart and separating the individual crystals, after which it is treated with an acid and water bath to remove solubles. It is then dried and sifted, to separate the various sizes.

Referring to the value of carborundum as an abrasive, Mr. George F. Kunz, of the firm of Tiffany & Company, of New York,

in an article in the *American Journal of Science* for December, 1893, states that he found that it would readily scratch red, blue, white, pink and yellow corundum in the form of fine gems, showing it to be an artificial substance that exceeds all natural substances except the diamond in hardness.

Owing to the limited facilities heretofore existing, the production of carborundum has been so small—not over 300 pounds per day—as to practically restrict its uses to the finer trades, such as the dental and manufacturing jewelers' trades, fine tool grinding, pearl grinding and kindred industries. The development in the dental trade especially has been remarkable, and in the form of discs, lathe and engine wheels and cloth-finishing strips, carborundum is rapidly displacing all other abrasive substances in this important industry, not only in the United States but throughout Europe.

An Alternating-Current Wattmeter.*

BY PROF. JOHN PERRY, F. R. S.

About two years ago I invented a very simple instrument, which measures watts exactly, however great the lag may be in amperes behind volts. Only one reading is necessary, and the instrument costs about the same as a Siemens dynamometer. I have had only one specimen made, and I have made no efforts to get it manufactured because I have found that in nearly all practical work the error when one uses an ordinary dynamometer is quite negligible. This is due to the fact that sufficient power is wasted even in an unloaded transformer in eddy currents and hysteresis to prevent the lag being excessive. But it may be that in the future greater exactness may be wanted, and it may be well to describe my instrument. I had intended to publish a number of tests made by Mr. Eborall, late of the Finsbury Technical College, but as they only bear out what any one can see to be true from the construction of the instrument I need not trouble the reader with them. Mr. Eborall constructed the instrument which he tested.

In the figure, $A\ B$ is any contrivance to which electric power is being given by alternating currents; it may contain motors, condensers, choking coils, lamps or other apparatus. There are two coils of wire, $E\ G$ and $E\ D$, which are wound together on the fixed bobbin of a dynamometer in such a way that if the same current passes from G to E and E to D no magnetic effects will be produced; in fact, the fixed bobbin is differentially wound. The coil $D\ C$ is the movable coil of the dynamometer. It is therefore evident that the reading of the instrument represents (to some scale dependent on number of turns of wire and the controlling moment) the average value of $(c_1 - c_2)\ c_2$ or $c_3\ c_2$. Now, $E\ A$ is a non-inductive resistance of amount R, and if this is known, since Rc_3 represents the voltage between E and A, the reading of the instrument represents the average power supplied to $A\ B$ and to the part $E\ B$. The power supplied to the part $E\ B$ is insignificant. The instrument is easily graduated and tested by continuous currents. Also at any time, by disconnecting $E\ A$, we can test whether $G\ E$ and $E\ D$ completely destroy each other's effects on the movable coil, and if they do not do so it will usually be found that a slight adjustment in position of one of the wires to the binding screws G or D will be a sufficient correction.

Even if the small power supplied, say, to an unloaded transformer is to be measured, and if the ordinary Siemens dynamometer frame and method of control be employed, I have found that the cost of and space taken up by the non-inductive resistance are not of importance. Of course, they are of less and less importance as the power is greater, and as the volts are less and if a more delicate method of control is employed. Any one who cares to employ this method will find it well to remember that if he uses considerable resistance between E and A, or if from any other cause the currents c_1 and c_3 are considerable and their difference small, it will depend upon the

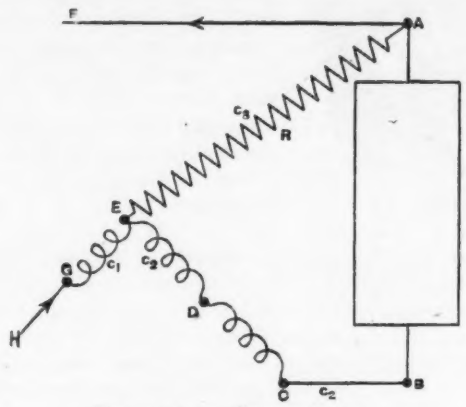


Diagram of Connections.

nature of the control whether there may not be too much heating of the fixed coil for its structural safety when measuring up to the limiting readings of the instrument.

In this description the words fixed and movable are interchangeable. The method is applicable to motor supply meters.

* From the London *Electrician*.

The Lachine Rapids Electric Transmission Project.

Work has been begun at Lachine Rapids, near Montreal, on the project to utilize the large water-power at that place in generating electric current for commercial use in the city of Montreal and suburbs. Work has been begun on the artificial canal on the north shore of the St. Lawrence. The cofferdam at the head-race is rapidly approaching completion, already extending 400 feet out into the rapids, and the preparation of the timber to be used on the permanent work has already been commenced. The dynamo houses, three in number, will be on isolated piers of masonry forming part of the main dam. There will be 66 60-inch turbine wheels working under a maximum head of eight feet and connected with horizontal shafting. The generators will be of 729 hp, and each direct-coupled to six turbines, the entire amount of power to be eventually generated amounting to 7,920 hp. The alternating current generated will be transmitted to Montreal at a high voltage, where it will be transformed by rotary transformers into direct currents. The illustration below gives a view of the portion of the bed of the river cut off by the cofferdams to form the head-race, and now ready for excavation to the necessary depth.

Site of Lachine Head Race.

Incandescent Lamps and Eyes'ght.

Dr. Gebhardt, of Budapest, says the London *Electrical Engineer*, has raised an emphatic protest against the practice of putting electric incandescent lamps at a low level among the wares in shop windows. He says this is exceedingly destructive to the eyes, and that these lamps should always be put out of the direct range of vision.

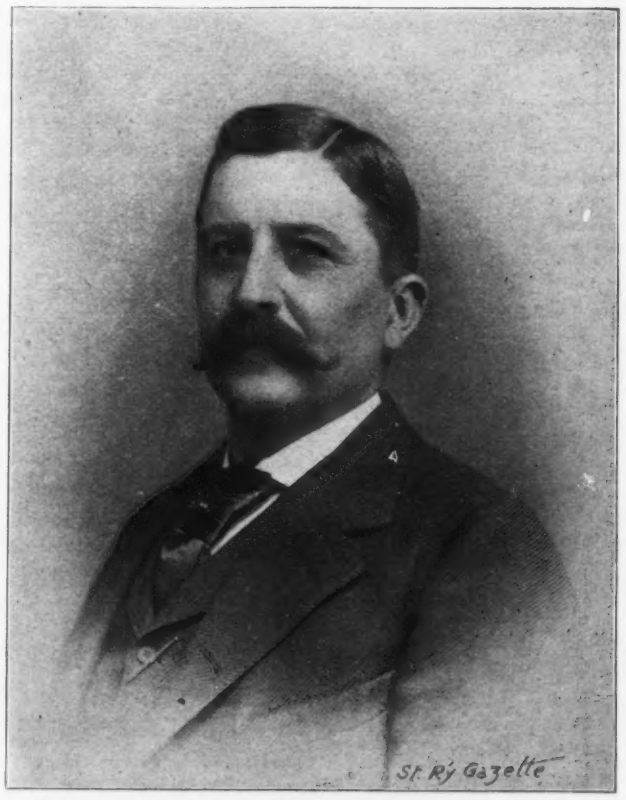
THE Montreal Convention of the American Street Railway Association was by far the most successful held by that body, and sets a standard for the future that can only be maintained by the most strenuous effort. The attendance was estimated to be not far from 1,000, thus exceeding by several hundred that of the very successful Milwaukee Convention, and, owing to the distant place of meeting, the comparison is much more significant than the figures indicate. The interest taken by every one in the objects of the meeting was most noticeable, and doubtless partly due to the several important questions awaiting decision, and to the fact that the annexed exhibition was well worthy the closest attention from street railway men. The latter feature exceeded the most sanguine expectations, as it was thought that, owing to customs duties, exhibitors would be deterred, which, however, was not the case; besides, the exhibits of Canadian manufacturers had an importance little expected, a score or more being most creditably represented.

The two principal measures coming before the meeting for decision excited much interest, but, as will be seen, did not meet with the approbation apparently expected by the executive committee by whom they were framed. That which excited the most lively discussion related to the admission as associates of other than street railway organizations; in other words, of manufacturers and supply dealers. When the matter came before the Convention it was at once apparent that the opposition was overwhelming, as the vote subsequently taken proved. The measure in regard to enlarging the scope of the Association was unfortunately handicapped by the discovery of the condition of the treasury, and therefore will have to await for action until next year.

A startling surprise to those not previously let into the secret was the announcement of a deficit in the treasury, amounting to nearly $5,000, which, it appears, had been accumulating for several years. The misfortune, however, served to demonstrate the hearty attachment of the members to the Association, for when subscriptions were asked to liquidate the indebtedness, the alacrity with which purses were opened showed a loyal spirit which gives a gratifying assurance as to the future of a body having a support so unselfish and so generous. That the action in this respect was prompted by a real *esprit du corps* was shown by the refusal of offers from outside interests to bear part of the burden, though the proffered aid could have been accepted with entire propriety.

We believe we express the feeling of all of those in attendance on the Convention when we say that the heartiness of the welcome received, and the pains taken on the part of the Montreal hosts to render the visit to Canadian soil a pleasant one, will always be a genial memory, and, as far as street railway men, at least, are concerned, has served to strengthen the ties of friendship between the sister countries. Montreal prides herself upon her character as an ideal city for such gatherings, and she can hereafter rely upon those whom she entertained last week heartily supporting this claim to its fullest extent. While it is true that, unlike at similar conventions in American cities, there was no committee of ladies to take charge of visitors of the fair sex, who formed a large contingent at Montreal, this is, perhaps, rather due to a difference in customs than to any lack of appreciation.

The banquet, the visit to Ottawa, and the fox-hunt were three features in themselves sufficient to make the Convention memorable. The wit, wisdom, and good cheer of the former, the jollity of the trip to Ottawa, and the unexpected diversion afforded by the hunt—in which one of the American guests carried off the honors—served as a fitting finale to a convention which will long be remembered as one whose success could scarcely have been greater.



H. M. LITTELL,
President of the American Street Railway Association.

The Convention was called to order by President Joel Hurt, at 12.30 o'clock. The Hon. J. O. Villeneuve, Mayor of Montreal, was then introduced and extended a cordial welcome on behalf of the citizens to the organization. Referring to the rapid development in electricity, he said that he would venture the statement that the electrical industry has produced more changes in the conveniences of civilization than any other dealing with forces subject to the power of man. President Hurt responded to the Mayor's welcome and was followed by Alderman Stevenson, who seconded the Mayor's remarks and assured the gentlemen present that they had fallen into good hands, Montreal being a city able to carry out anything in the way of receptions and in a style seldom equaled.

President Hurt then delivered his inaugural address, in which he dwelt upon the great strides made by the street railway industry. There are in operation in the United States, he said, 179,300 miles of steam roads, and about 13,500 miles of street railways. The street railway mileage of the United States is thus about 7½ per cent. of the steam mileage, while the passenger receipts are 45 per cent. of the corresponding receipts of steam roads. The total capitalization of street railways is about $1,300,000,000 or about 11 per cent. of the capitalization of steam roads, while its profits are $43,000,000, or about 13½ per cent. of steam roads.

As new questions to be considered, he referred to the handling of freight and mail, the delivery of small parcels of retail stores, the handling of building material in suburban localities and of milk on special cars for the purpose; and the operation of funeral cars from any portion of a system into cemeteries where special facilities are provided. He called upon the companies to lend mutual aid through the association in defeating hostile legislation in national, State and municipal governments, and to endeavor to implant in the minds of patrons the truth that public interests demand friendly legislation as tending to enable the industry to furnish the best and most rapid transportation. As to the relation of street railways to steam roads, he asks whether the interests of these two systems of transportation may not force an amalgamation,

the main lines on their part connecting distant points and then transferring passengers to street railway lines for transportation to their final destinations. President Hurt believes that the time has come when a larger revenue must be raised for the support of the association, either upon the assessment plan or by increasing the membership dues, and that the great and important question for the present Convention is the enlargement of the scope of the association, which is a matter that will be considered later in a report from the Executive Committee.

After the president's address some routine business was transacted and the Convention then adjourned.

AFTERNOON SESSION.

The session was called to order at 2.20 p. m., and, after waiting until a quorum was gathered, Mr. E. J. Wessels read his paper on "The Present Status of the Air-Brake."

Mr. Wessels referred to the great change of opinion, which has taken place with respect to the desirability of using air-brakes, the

Granville C. Cunningham,
First Vice-president.

diffidence which existed even in influential circles a year ago having largely disappeared. It is now admitted that more reliable braking apparatus must be secured, and some go so far as to say that better brakes must be had at any price. Mr. Wessels believes that it is very inadvisable for a street railway company to make its own brakes, the question of such manufacture being one so difficult, and the outlay for experiments so very great, that no individual road would be justified in undertaking it.

Among the difficulties referred to against which the street car brake has to contend is the unfamiliarity of the average motorman with its proper use, the disinclination to give up the space necessary for the compressor on the car axle, the neglect of proper inspection, and insufficient lubrication. Mr. Wessels stated that the street car air-brake had been adopted by the Australian government, is specified by British engineers in Great Britain, and is being installed in different places on the Continent; it is therefore, he added, somewhat discouraging to find, in view of this, that it is denied proper attention here. The duties, he said, required of the street car brake are more difficult than those demanded of the steam-car brake on account of the greater number of stops and grade crossings, and the air-brake with its emergency stop is the only kind of brake which can meet these conditions properly. Much stress is laid upon the necessity of more intelligence in motormen or more thorough instruction where the air-brake is used; for, with the ordinary motorman, the most absolutely perfect brake in existence would be in jeopardy every hour. Street railway men are, therefore, earnestly advised to give proper instruction to their men before intrusting them with the operation of this apparatus. Mr. Wessels believes it is extremely probable that the use of air-brakes before long will be made compulsory, and, therefore, street railway managers should test them in actual service now in order to become familiar with them. In conclusion, Mr. Wessels gave as the questions to be considered with respect to air-brakes, the following:

First: Are better brakes than hand-brakes necessary? Second: Will not the demand for better brakes become more and more imperative day by day? Third: Will not some form of power brake become compulsory before long? Fourth: How can the value of any brake (mechanical or otherwise) be judged except by tests in every-day service? Fifth: How can anything undergo a fair trial unless the men who use it are compelled to exercise diligence in its operation? Sixth: How can immovable machinery or apparatus be expected to operate satisfactorily unless the moving parts are kept lubricated? Seventh: Can a street railway car operate without having a reliable braking system for checking speed and making service and emergency stops?

In the discussion of Mr. Wessels' paper which followed, Mr. Scullin of St. Louis stated that two air-brakes had been tried on his line and trouble was experienced when the cars were run through crowded sections, the speed being then so slow and the stops so frequent that it was found almost impossible to maintain sufficient pressure. Also on account of connecting the vacuum brake to the same rod as the hand-brake, the latter was neglected and became almost impossible to use. Still another objection was that the wires of the motors came in contact with the piping of the brakes, whereby the insulation was worn off, short-circuiting ensued, and holes burnt through the pipe. Mr. McCulloch of St. Louis spoke of a case in his city where a car had been fitted with air-brakes which operated with the greatest of satisfaction, and several other cars were consequently equipped. In a short time, however, the repair bills were found to be growing to such large proportions that the air-brakes were taken off, and to-day there are none in use in St. Louis. He stated that the trouble arose principally from the fine particles of dust which continually cut out the packing.

Mr. Wessels, referring to the objection of Mr. Scullin, said that no air-brake is fit to be in service that has not a minimum reserve of fifty stops, so that if there should be no movement of the compressor that many would be available. As to the type of air-brake used in St. Louis of which Mr. McCulloch spoke, Mr. Wessels said that it has since disappeared from the field, and added that on the St. Louis & Suburban Road, five of these brakes which broke down were rebuilt, as the management realized most emphatically the necessity of air-brakes. Mr. Wessels also stated that in one form of air-brake no trouble is experienced from the noise of the exhausts as a device is used to silence it.

Following the discussion of Mr. Wessels' paper, Mr. Seely brought up the subject of street paving. He related that in building a railroad in a certain city where the street railway companies were compelled to pave with asphaltum a strip eighteen feet in width where its tracks are laid, the paving contractors refused to do the

T. C. Penington,
Secretary.

work unless all traffic was suspended. The railway company has commenced to lay the concrete itself and is now thinking seriously of constructing a plant to lay down the asphaltum surface. Mr. A. Langstaff Johnston said that in the work under his charge in Philadelphia he had paved many miles of streets; the authorities there required the whole street to be paved by the street railway company, and the bills amounted to a great many hundreds of thousands of dollars, but in no case was the street given up to the contractor, and such a demand he pronounced to be utterly unreasonable. Mr.

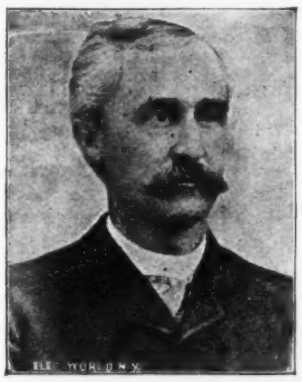
Johnston stated that in Richmond the tracks of the electric railway are to be laid on concrete, and it is not proposed to stop traffic for one minute. Mr. McCulloch of St. Louis said that no contractor had ever asked his company to discontinue the running of cars while the street was being paved, and he pronounced it both unnecessary and unreasonable to ask a company to do so.

The Convention then adjourned until Wednesday morning at 10 o'clock.

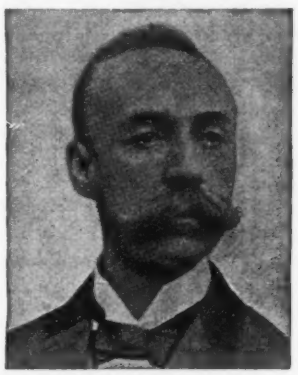
The Convention met at 10:45, and at once went into executive session, where the subject, "The Labor Question," was taken up and discussed by Messrs. Wyman, Jackson, Hurt, Sergeant, McCulloch, McLean, McClary, Charlton and Connette. A paper by Mr. Baumhoff, of St. Louis, on "Transfers," was next read, and the discussion following was participated in by Messrs. Sergeant, Charlton, McCulloch, Jackson and Hurt.

AFTERNOON SESSION.

The Convention assembled in executive session at 2:15, and received the report of the executive committee, recommending certain amendments to the constitution.



Joel Hurt.



W. W. Bean.

The report refers to the surprising discovery at a meeting held in May that the liabilities of the Association exceeded its assets by nearly $5,000, due to the fact that the receipts had been insufficient for the work cut out by the Association at its annual meetings. The deficit on Sept. 30, 1895, amounted to $4,087.33. The committee recommended that the scope of the Association be extended to include a bureau of information for the purpose of collecting and disbursing statistical and general information as to the management and operation of railway properties, insurance, legislation, and investigation of legality and value of patents, and such other matters as may from time to time be referred to it by the Association or its executive committee; and that associate members be admitted to increase the income of the body. It was also recommended that a uniform charge of $5 be made for banquet tickets.

In suggesting these changes the committee stated that it had endeavored, first, to vastly increase the useful work of the Association for the benefit of its members, and second, to provide the necessary funds for the accomplishment of this work in such a way as to place the burden justly and in a manner such that they can be borne easily and without the slightest difficulty by large and small companies alike.

Later in the session a committee of ten was appointed to devise ways and means for meeting the deficit in the Association treasury.

Mr. W. T. Hammer asked the Association to co-operate with the National Electric Light Association in securing the adoption of one standard code of rules for electrical construction and operation, and upon motion the executive committee was authorized to appoint a delegate.

Upon return from a recess taken to enable members to attend a reception of the McGill University, the report of the committee was again taken up and discussed by Messrs. Harrison, Hamilton, Jackson, McCulloch, Thompson, Hurt, Cunningham, Wyman and Fairchild. It was finally concluded to defer final action until the meeting of the Association next year.

An invitation to visit the McGill University was taken advantage of by a large number of delegates. Very favorable comment was elicited by the technical equipment of the engineering building, which contains extensive hydraulic, engineering and electrical laboratories and a laboratory for testing the strength of materials.

After the morning session was called to order, Mr. N. W. L. Brown submitted a paper on "Cross Ties and Poles."

The report presents evidence to show that the life of a street railway pine tie of the best quality is but six years, and eight years is the longest life that may be expected of oak, these figures corresponding closely with those met with in steam railway practice. Many street railway engineers were conferred with and no uniformity of opinion found as to the best tie to use. One engineer prefers oak, another tamarack, another chestnut, another cedar, another cypress, another Georgia pine, and a few engineers claim to have solved the problem by adopting metal ties. The report says that it is conceded that metal ties require to be thoroughly bedded in concrete, but as most American engineers claim that concrete is not necessary otherwise in first-class roadbed construction, there are, therefore, few cases where metal ties will be economical. In New Orleans, where the soil is very damp, excellent results have been obtained under horse-car tracks with red cypress, but their inability to properly hold spikes is a serious hindrance to their extensive adoption for street railway use. There was much diversity of opinion encountered as to the merits of cypress timber, the several varieties of which are very different in quality and difficult of distinction, but the report concurs in the opinion that black cypress ties ought to last about ten years,

The report pronounces strongly in favor of efficiently creosoted ties as the most economical for use in street railway work, being declared superior to "burnettized" ties or those treated with zinc chloride; the objection to the latter is that the chloride is easily washed out when exposed in wet localities, the leakage from the rails tends to decompose it and it rusts the rails and spikes. The average life of creosoted beech ties on the Northern Railway of France is 27 years, and spruce ties submitted to the same treatment last in England from 16 to 20 years; many cases have been reported in this country where creosoted timber was sound after 16 years of use. Its advantage in street railway work is that the creosote cannot be washed out; being a perfect insulator, it is not subject to electrolytic action from leakage of current, and its tendency is to prevent iron and steel from rusting.

Mr. Brown stated that his company has recently used 3,000 sap-pine ties each treated with 12 pounds of creosote per cubic foot, and delivered at Atlanta for 60 cents each. First-class pine ties now cost

Russell B Harrison.

J. H. Cunningham.

in Atlanta 26¼ cents each, oak ties 30 cents and black cypress ties about 40 cents each.

Assuming the ties to be 5 by 9 inches by 7 feet (which the report considers the most satisfactory size) and spaces 2 feet 6 inches apart; that the life of a creosoted tie may safely be assumed to be 24 years; and that the cost, with present wages, of tearing up and renewing the ties and repaving with Belgian blocks, is about 36 cents per linear foot, then from these data and counting six per cent. interest, it follows that $1,46 is the actual cost per linear foot of keeping creosoted

ties under track for 24 years; with cypress ties having a life of 12 years, renewals, principal and interest, will bring the corresponding price up to $2.16; oak ties, with a life of eight years, and costing 12 cents per linear foot will amount to $2.82; pine ties costing 10½ cents per linear foot, and with a life of six years, would aggregate $3.08 for the same period. From these comparisons it will be seen that cypress will cost 48 per cent. more than creosoted timber, oak 92 per cent. more and pine 111 per cent. more, the service with the different ties being considered equally satisfactory; this latter assumption, however, is not practically correct, with respect to cypress, on account of its softness giving inferior service.

The report states that it will be economy for any street railway company operating an extensive mileage to install a small creosoting plant on the power-house premises, supplying steam from the main boilers, and power for the pumps being derived from electric motors. Porous wood is necessary for proper treatment, and while beech seems to give the best results, spruce and sap pine are standard articles for treatment. In many localities, particularly in the South, sap pine ties could be purchased and treated at a cost not exceeding 20 cents each. It is estimated that a plant with a treating cylinder 6 feet in diameter and 36 feet long and with a capacity of about 300 ties per day, should not cost more than $6,000, complete. Such a plant would also be of service for treating floor timbers for cars, trestle and bridge timbers and especially for cross arms for line construction.

On Mr. Brown's road red cedar poles are almost entirely used although iron poles set on concrete have been employed in the heart of the city, and cypress poles are used in a few isolated cases. The specification of cedar poles require them to be 28 feet in length with a minimum top diameter of 6 inches, but these dimensions have been found to be too small for electric railway service.

The Western Union Telegraph Company estimates that their red cedar poles last on an average about 15 years. The sap generally decays in five or six years, and in many cases it has been found that the heart decays in 12 years, though there are cases where 20 years is the limit. The objection to cedar poles for street railway use is that their life is practically limited to the life of their sap, as when this decays, the heart is too small and weak for reliable service. Large poles are likely to be defective, generally being hollow at the butt and frequently containing rotten knots. Cedar is brittle and treacherous under tension and heavy short poles are excessively expensive. Mr. Brown estimates that cedar poles with large hearts will last 12 years and cost about $4 each when erected. Iron poles cost about $18 each erected, but they exhibit too great a tendency to rust near the ground, and it is doubted if they can be safely depended upon for more than 15 years. Mr. Brown believes that properly creosoted poles 30 feet long and 8 inches at the top should be equal to any poles on the market with respect to excellent service, and of longer life. Such poles treated by contact with 10 pounds of creosote per cubic foot should not cost more than $5 when erected, and when treated in one's own plant this price could doubtless be reduced to $3.50. Creosoted pine poles would be strong enough and sufficiently neat for city work, while their long life makes them eminently suited for all purposes.

Mr. W. H. Preece has said that in 30 years' experience he has never seen one properly treated telegraph pole that showed the presence of decay, and he referred to a particular lot of 318 poles which, when replaced by larger poles after 35 years of service, showed no signs of decay. Experience in America has been similar to this, although the length of time treated poles have been under observation is less. The reason why they are not used by the Western Union Telegraph Company is stated to be on account of the inflammability, most of the lines of that company being along railway lines.

The report of the committee on patents was then read by Mr. Frank R. Green.

The report includes a discussion of the advisability of attaching a bureau to the Association to handle all matters pertaining to patents as they affect street railways. The work in this direction of the Eastern and Western Railway Associations is reviewed, and is stated to have accomplished a most admirable purpose, the number of suits against railroads regarding patents having been most materially reduced, and $60,000,000 in judgments defeated in a single year. Several instances are quoted of street railways paying large sums of money to prevent suits on alleged infringements, which expenditure might have been saved if an organization of the kind proposed had been in existence.

The most important points to be achieved by such a bureau are enumerated as follows: Lessening the total expenses of fighting patent suits, as a suit affecting one road would also affect others; uniformity of action; additional safety in adopting new devices; greater facility in defending suits, and decrease in their number; advantage entailed in settling suits and contesting and avoiding unfair and unjust royalties; reduction of prices on all patented articles; enabling suits against any of its members to be shifted to the manufacturers in cases of claims for royalties on articles made by the latter; the dissemination of valuable information to members respecting suits, in which one or more are directly concerned; reporting on the patentability of any device gotten up by any of the street railway companies; enabling full and authentic information to be obtained in regard to devices commonly found in use on all street railways; lists of new patents and opinions concerning their scope and value; lists of expired patents; the acquirement of models, drawings, etc., for permanent exhibition.

The Committee recommends that a bureau to handle all matters pertaining to patents as outlined above be established by the Association, and that those availing themselves of its facilities shall pay a sum annually, in addition to the membership fee, sufficient to pay the expenses of the bureau.

AFTERNOON SESSION.

The session opened at 3.15 p. m. with Vice-President Bean in the chair.

The committee of ways and means presented its report, which recommended that the several members of the Association be requested to contribute a sum of not less than $15 each to liquidate the floating indebtedness of the Association; that hereafter a uniform charge of $5 be made for banquet tickets; that individuals and firms, other than companies, lessees and owners of street railways, be admitted to associate membership, and that conventions hereafter shall be opened on Wednesdays and continue in session for four days.

The discussion on the report was very spirited, and referred entirely to the clause relating to the admittance of electrical manufacturers and dealers as associate members. Messrs. Harrison, Ackerman, Green and Seely spoke in favor of this departure from the former policy of the Association, but Mr. Thompson, who argued against it, seemed to express the sentiments of the meeting, for the report was tabled by a report of 87 to 11. The representatives present of companies belonging to the Association were then invited to volunteer subscriptions to liquidate the indebtedness of the organization, and in a very short time $4,475 was pledged.

The nominating committee reported, recommending the following gentlemen as officers for the ensuing year, who were unanimously elected:

President, H. M. Littell, Brooklyn, N. Y.; vice-presidents, G. C. Cunningham, Montreal; William H. Jackson, Nashville, Tenn.; J. Willard Morgan, Camden, N. J.; secretary and treasurer, T. C. Penington, Chicago; executive committee, Joel Hurt, Atlanta; Prentiss Cummings, Boston; C. G. Goodrich, St. Paul, Minn.; A. Markel, Hazleton, Pa., and W. F. Kelly, Columbus, O. The recommendation of the committee that the next convention be held at St. Louis, Mo., was adopted.

The committee on the use of salt and sand on street railway tracks, consisting of Messrs. Hamilton and McCulloch, submitted their report, which expresses the opinion that the use of salt is at times indispensable to clear the rails of a film of ice which otherwise would render the operation of cars unsafe, particularly on hilly roads. The use of salt for the reason given is pronounced more imperative with electric than with horse traction. The use of sand is also considered a necessity to give the wheels a proper grip. It is stated that in St. Louis 3,000 tons of salt are used each Winter without objection from the local authorities or health board.

EVENING.

The crowning feature of the most successful street railway convention ever held was the banquet at the Windsor Hotel in the evening. About 250 seats were occupied. President Joel Hurt presided, with Chief Justice Sir Alexander Lacoste and United States Consul-General Anderson on the right, and Mayor Villeneuve and Senator Olgilvie on the left. Among the other guests at the president's table were Mr. Russell B. Harrison, Hon. Louis Beaubien, minister of agriculture; Alderman Stevenson, Col. Cunningham, Messrs. Bean and Stedman. The large dining room of the Windsor Hotel was handsomely decorated with ferns, foliage plants and the national flags and emblems. President Hurt proposed the first toast,

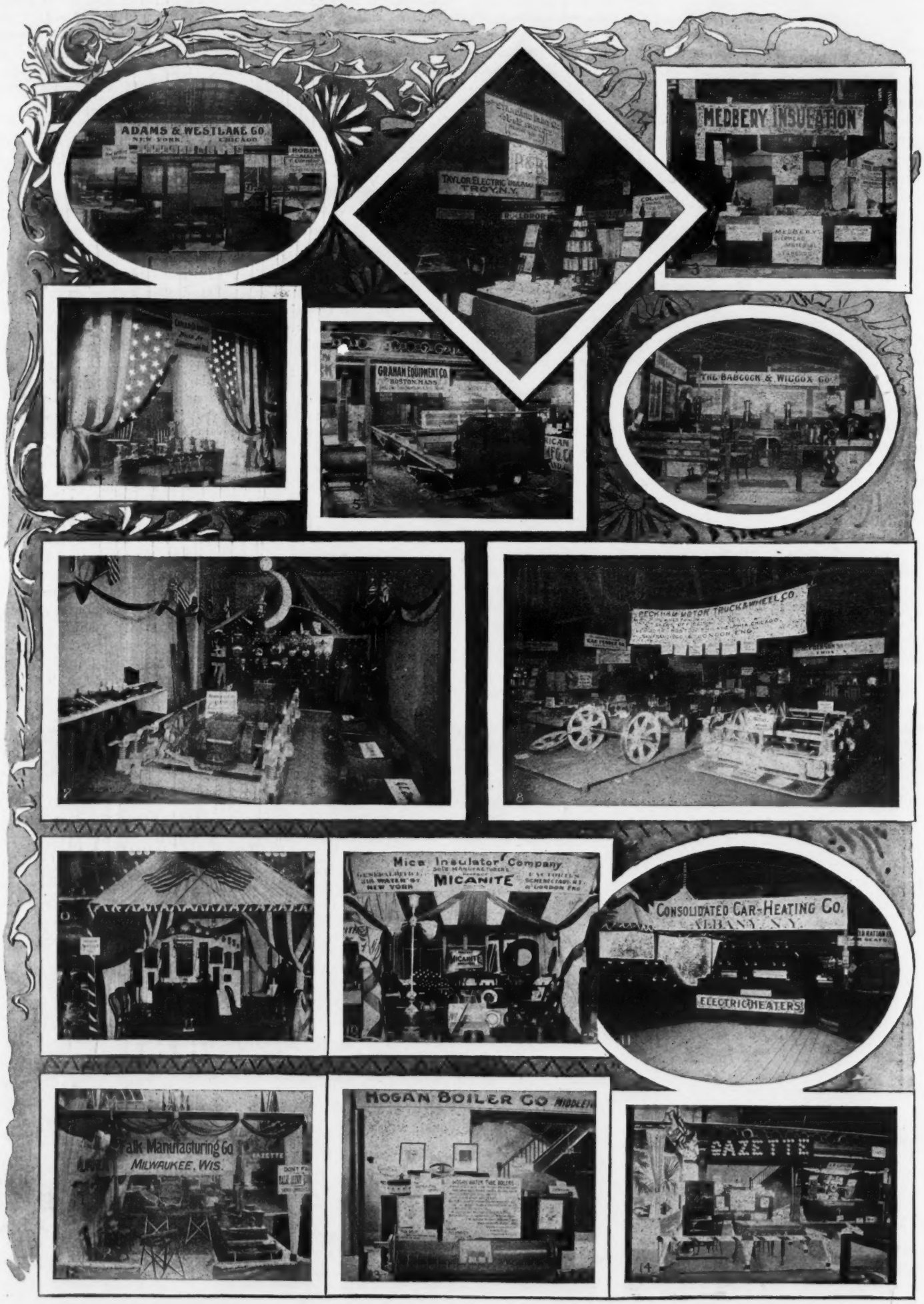
"Her Majesty, the Queen," in happily chosen words, and was followed by Sir Alexander Lacoste, who, amid great enthusiasm, proposed "The President of the United States," to which toast Consul-General Anderson responded. Among others who responded to toasts were Mayor Villeneuve, Alderman Stevenson, Hon. Louis Beaubien, Senator Olgilvie, Col. Cunningham and Mr. J. H. Stedman, of Rochester, the latter making a witty and clever response to the toast "The Ladies." The occasion was a most thoroughly enjoyable one in every way, and will long be remembered by those present.

After the meeting was called to order at 11 o'clock the subject of furnishing free music and other entertainment by street railway companies was taken up for discussion. Mr. McLean stated that the electric railway company at Indianapolis owns the largest park in that city, comprising 265 acres, and the concerts and entertainments given there largely increased traffic receipts, particularly on Sunday afternoons and evenings. This Summer a militia encampment was held in the park, and at no time were there any accidents owing to crowding. Mr. McClary said that his road at Birmingham, Ala., had a park of about 100 acres, including a lake of 33 acres; a band for dancing played every week-day night during Summer except Sunday, and a sacred concert on Sunday afternoon. The outlay necessary was found to be profitable. No accident has ever occurred in carrying large crowds to and from the park, though during two years militia encampments were held there, when as many as 8,000 people were in the grounds at a time. Messrs. Hurt and Penington both concurred in the opinion that any greater liability of accidents occurring was not appreciable under the circumstances; the former said that on such occasions every one is more on the lookout, and if an accident does occur it is less likely to be heard from. Mr. Penington stated that on "Chicago Day" at the World's Fair, when 800,000 people were carried, the only injury was to the arm of a man shoved off a car.

Mr. J. F. McElroy then proceeded to read a paper on "Electric Car Heating," which was practically the same as one read by the same author at the recent meeting of the New York State Street Railway Association at Albany, an abstract of which appeared in THE ELECTRICAL WORLD of Oct. 5.

According to the original programme, the Convention was to adjourn on Friday, but the Montreal committee of arrangements had prepared as a programme for another day an excursion to Ottawa. Accordingly, the special train of seven coaches carried the visitors to Ottawa, where they were transferred to special cars provided by the Ottawa Electric Railway and taken to the Parliament Building, where a reception took place in the Senate chambers. An address of welcome was delivered by the premier, Sir Mackenzie Bowell, who expressed the hope that the Americans would go home with a better opinion of the Canadian people than they had entertained before visiting the Dominion. He referred briefly to the local street railway system which, he said, was unexcelled on the continent. He alluded to the significance of the Convention, and remarked that when people of different nationalities were brought into contact, the effect would, he was sure, conduce to breadth of view with respect to each other. The public sentiment was one of peaceful rivalry with the people of the neighboring republic, and Canadians were anxious to emulate the virtues and successes of their American cousins. In conclusion, the premier invited the Americans present to study the Canadian system of government and go back with new information and ideas concerning British rule in the Dominion. Mr. J. H. Gallinger, of New Hampshire, replied to the address of welcome, saying that the delegates were present to cultivate the spirit of amity which existed between Canada and the United States. The time had long passed for strife on the North American continent. The Americans loved Canada, he thought, a great

SOME OF THE EXHIBITS AT THE MONTREAL STREET RAILWAY CONVENTION.



STREET RAILWAY EXHIBITS AT MONTREAL.

1. Adams & Westlake Co. 2. Standard Paint Co. 3. Fiberite Co. 4. Cambria Iron Co. 5. Graham Equipment Co. 6. Babcock & Wilcox Co. and Goubert Manufacturing Co. 7. General Electric Co. 8. Peckham Motor Truck & Wheel Co. 9. C. W. Henderson. 10. Mica Insulator Co. 11. Consolidated Car Heating Co. 12. Falk Manufacturing Co. 13. Hogan Boiler Co. 14. "Gazette" Headquarters.

STREET RAILWAY EXHIBITS AT MONTREAL.

15. Model of Brill Maximum Traction Truck. 16. Micanite Insulation in Unusual Forms. 17. Roll Slipless Car Wheel Co. 18. Peckham Flexible Gear. 19. General Electric Locomotive Controller. 20. Aluminum Model of Peckham Truck. 21. Models of Brill Standard and New Radial Trucks. 22. Construction of Walker Motor Armature. 23. Model of Spring-supported Wheels. 24. Crane Co. 25. Meneely Tubular Bearing. 26. Chapman Valve Co.

deal more than Canadians realized, and while the Republic might once in a while cast longing eyes in the direction of Canadian soil, the governments of both countries had come to a realization of the fact that there is room for two great nations in North America to exist side by side in terms of the closest friendship. He paid a high compliment to Canadian educational and charitable institutions, and expressed the appreciation of the strangers for the hospitality and courtesy extended to them.

At half past twelve the delegates partook of lunch at the Russell House, and were afterward taken charge of by officials of the Ottawa Electric Railway, who placed special cars at their disposal. They returned to Montreal by special train in the afternoon.

Through the kindness of the Forest and Stream Club, of Montreal, members of the Association and their friends were invited to take part in a fox hunt. The invitation was accepted by many and a party of ladies and gentlemen, 300 strong, assembled at the park where the hunt was to start from. The Forest and Stream Club provided four cars of horses, each car containing 16, and the visitors were very much interested in the unloading of the animals. Carriages were provided for those who did not take part in the hunt, and they were driven to a high point in the country which it was expected the hunt would pass, but the fox did not assist in carrying out this programme and disappointed the waiting visitors by heading in another direction. Forty hounds and two terriers took part in the hunt. Ex-President Joel Hurt rode "straight to the hounds" and was awarded the head, and also distinguished himself by capturing a live pheasant which became entangled in a wire tennis fence.

C. W. Henderson, of Montreal, had on exhibition an extensive line of electrical supplies.

The Jewell Belting Company, of Hartford, Conn., was represented by Mr. S. Tolles.

H. J. Wightman, of H. J. Wightman & Co., Scranton, Pa., presented some cogent arguments concerning the merits of his rail bonds.

A. Roy MacDonald, of Montreal, had a most unique exhibit, his booth being profusely decorated with mica cut in every conceivable shape and the rear portion of it made up to represent a mica mine.

The Chloride Accumulator Company, of Philadelphia, was represented by Mr. Arthur E. Childs, manager of the New England office, who talked interestingly to all visitors on the subject of storage batteries.

Adam Cook's Sons, of New York, had an extensive exhibit of their Albany grease which has been in high favor with engineers in all classes of work for over 20 years. The company was represented by Mr. M. N. Peavey.

The H. W. Johns Manufacturing Company, of New York, was represented by Messrs. Henry G. Issertel and E. B. Hatch, who enthusiastically presented the merits of moulded mica for insulating overhead railway material.

J. W. Range, representing the Consolidated Car Fender Company of Providence, R. I., had one of the most attractive exhibits, and through the merits of his apparatus and courteous treatment of visitors won universal favor.

The R. D. Nuttall Co., of Allegheny, Pa., whose name is so thoroughly familar throughout electric railway circles, was represented by Messrs. F. A. Estep and Charles J. Mayer, with headquarters at the Queen's Hotel.

Mr. E. W. Little, of the Interior Conduit & Insulation Company, of New York, had something new to show in the way of an underground conduit system for feeder cables, which attracted a great deal of attention and was very favorably criticised.

Sibley & Co., of New York, had on exhibition a telephone system for use in connection with electric railways. The system utilizes the trolley current in its operation and involves very simple apparatus. Mr. T. M. R. Meikleham represented Sibley & Co.

The Cambria Iron Company, of Philadelphia, was represented by its New York agent, Mr. William C. Washburne, who displayed a most interesting collection of rail sections of various sizes and weights designed for all kinds of street railway service.

Morris, MacCurdy & Smith, of Indianapolis, Ind., showed samples of Phœnix rubber insulating paint, and were represented at the Convention by Mr. Elmer P. Morris, who lost no opportunity to impress visitors with the merits of his company's product.

The Abendroth & Root Manufacturing Company, of New York, was ably represented by Mr. P. M. McLaren, who talked convincingly to visitors on the subject of Root boilers, and called attention to the successful record made by these boilers in electric power stations.

The Goubert Manufacturing Company, of New York, was on hand as usual with a model of its well-known feed-water heater and Stratton steam separator, which are in such extensive use, and are so thoroughly and favorably known as to render any comment superfluous.

The Tandem Brake Company, of New York, had an interesting exhibit, consisting of one of its brakes mounted on a car of the Montreal Street Railway Company, the operation of which was very successfully demonstrated. Messrs. Edward B. Wyman and A. W. Dingham represented the company.

The American Electrical Works, of Providence, R. I., was ably represented by Messrs. W. A. Hathaway, F. E. Donohue, John Carroll and P. C. Ackerman, who took good pains that the excellent record made by their company's product should not escape the attention of any of the visitors who came their way.

The John A. Roebling's Sons Company, of Trenton, N. J., was represented by Messrs. Doyle and Cockey, who showed a comprehensive collection of the numerous classes of wires and cables manufactured by their company, and so universally used by electric light and railway companies throughout the country.

The Walker Manufacturing Company, of Cleveland, Ohio, had a large and well-arranged exhibit, including two Peckham trucks equipped with the Walker Company's latest type of motor. A number of motor armatures were shown in different stages of construction, together with a large line of other apparatus.

The Ohio Brass Company, of Mansfield, Ohio, had a fine exhibit of overhead material, including Wood flexible pole brackets, Walker trolley harps and wheels, King straight underrunning switches, and type K and type W trolley hangers. The company was represented by Messrs. C. K. King, J. F. Macartney and Charles Traxler.

The Peckham Motor Truck & Wheel Company, of New York, had an admirably arranged exhibit consisting of two handsomely decorated Peckham trucks and a collection of separate parts illustrating details of construction. One of the trucks was equipped with a Peckham emergency brake, which elicited much favorable comment from the practical street railway men who inspected the device.

The Forest City Electric Works, of Cleveland, Ohio, had a had a fine display of roll drop commutator bars, in charge of Messrs. W. B. Cleveland and John C. Dolph. These bars are formed cold by means of a die and a 400-pound drop hammer, which method, it is claimed, turns out a much superior product to that made by the hot process.

The McGuire Manufacturing Company, of Chicago, relying upon the extensive use of its trucks to familiarize railway men with them, made no exhibit, but were represented at the Convention by Messrs. W. J. Crook and J. A. Hanna, whose able efforts in behalf of the McGuire trucks rendered unnecessary any display of the articles themselves.

J. Lester Woodbridge, of the Times Building, New York, interested a great many of the delegates in a "Booster" system, by which expensive feeder wires are obviated in a great many cases. This system, for which Mr. Woodbridge is sole agent in the United States, was recently installed on the lines of the Chester Traction Company, of Chester, Pa.

The Babcock & Wilcox Company, of New York, had an exceedingly instructive exhibit comprising various parts of their boiler, which showed that a high degree of mechanical skill was employed in its construction. The forgings for uniting the tubes at their ends were intricate pieces of work, but at the same time possessed of exceedingly great strength.

The Fuel Economizer Company, of Matteawan, N. Y., had a thoroughly practical exhibit consisting of an equipment of Green fuel economizers in the power-house of the Montreal Street Railway Company. Messrs. A. H. Blackburn, William Downs and Stanley

Green spared no pains to acquaint visitors with the peculiarities and merits of these economizers.

The Akron Insulator & Marble Company, of Akron, Ohio, had a fine exhibit of its marble, porcelain and earthenware insulators, in charge of Mr. A. L. Daniels. Mr. Daniels also exhibited a line of goods made by the H. B. Camp Company, of Aultman, Ohio, who make the well-known Crump vitrified clay conduit, which is in extensive use by telegraph and telephone companies.

The Lombard Hydraulic Brake Company, of Boston, represented by Mr. H. M. Daggett, Jr., had one of the cars of the Montreal Street Railway Company equipped with its brake. The car made a great many trips running on regular schedule time, and large numbers of street railway men rode upon it and investigated the action of the brake, which was pronounced admirable.

The Robinson Electric Truck & Supply Company, of Boston, was represented by Mr. William Robinson, and showed an aluminum model of its truck on a curve. The model was a six-wheel truck and it was only necessary to push it along the bent rails in order to realize that the power necessary to carry one of these trucks around a curve in actual practice is certainly reduced to a minimum.

The J. G. Brill Company had headquarters in the parlor opposite the elevator in the Windsor Hotel, where various models of Brill trucks were shown, among them being the maximum traction truck, the merits of which were fully explained by Messrs. John A. Brill, M. E. Curwen, Samuel Curwen and W. H. Heulings, Jr., who neglected no opportunity to make visitors thoroughly at home in the Brill parlor.

The Benedict & Burnham Manufacturing Company, Waterbury, Conn., was represented by Mr. J. H. Woodward, who had an exceedingly effective exhibit of which "solid one-piece rail bonds" formed a very prominent part. The company displayed a sign stating "We lead the world in rail bonds," which statement the manufacturers express themselves as being prepared to demonstrate to the satisfaction of everybody.

Frank S. De Ronde, general sales agent for the Standard Paint Company, of New York, was ubiquitous, and put in some telling efforts for "P. & B." products. Mr. De Ronde could be seen all hours of the night engaged in presenting the merits of "P. & B." goods to the few who had been hitherto ignorant of them, and refreshing the memory of the large number of street railway men who were familiar with his goods.

The Graham Equipment Company, of Boston, was represented by Mr. J. H. Graham, and exhibited a steel-framed car which, complete, ready for the motor, weighed only 3½ tons. It is interesting to note that this car during the exhibition was sold to the Toronto Street Railway Company, of Toronto, Ont., whose engineers were so well pleased with the truck that they recommended their company to secure the right to manufacture it in the Dominion.

The Standard Underground Cable Company, of Pittsburg, Pa., exhibited a large number of sections cut from cables now in actual use, and specified the localities from which the sections were taken. The large number and wide geographical distribution of these localities show conclusively the popularity of Standard cables in all parts of the country. Messrs. G. L. and James R. Wiley represented the company most effectively.

The Consolidated Car Heating Company, of Albany, had an exhibit which was particularly attractive from a physical as well as a technical standpoint. The warmth distributed by its car heaters was thoroughly appreciated by the visitors, large crowds of which were constantly congregated around the exhibit. Mr. J. F. McElroy, the company's engineer, explained in detail the arrangement and characteristics of the heaters. Mr. McElroy was ably assisted by Mr. H. H. Ransom.

The Billings & Spencer Company, of Hartford, Conn., was represented at the Convention by its New England agent—the Pettingell-Andrews Company, of Boston—who distributed some of the most attractive specimens of typographical work to be foundat the Convention. The catalogue described and illustrated in detail a full line of B. & S. overhead material and also included Billings' patent drop forge commutator segments, which are in almost universal use by both street railways and manufacturing companies.

The General Electric Company had a particularly attractive exhibit from both a technical and an æsthetic standpoint. The principal feature of practical interest was the Sperry electric brake, which was shown in connection with a series-parallel controller. The display also included the General Electric Company's three types of railway motors, the new K 2 controller, a full line of overhead material and a very handsome marble switchboard. The exhibit was elaborately decorated with flags and incandescent lamps.

The Hogan Boiler Company, of Middletown, N. Y., exhibited among a number of interesting devices, feed-water inductors, manhole plates with copper gaskets for high-pressure service, sleeves for extending tubes above the water line and samples of specially made cold-bent charcoal iron tubes. The company was represented by Mr. J. J. Hogan, whose energy and success in overcoming a number of exceedingly discouraging hindrances to the establishing of his exhibit commanded the admiration of all those who knew of the circumstances.

The Cutter Electrical & Manufacturing Company, of Philadelphia, made a handsome exhibit of its automatic circuit-breakers, switches, etc. The circuit-breaker in particular attracted a great deal of attention, and it impressed Dr. Cary T. Hutchinson so favorably that he specified this device for the switchboard of the Library of Congress building to replace the combined fuse-block and switch now in use there. Mr. W. E. Harrington was in charge of the exhibit and neglected no opportunity to further the interests of his company.

The Westinghouse Electric & Manufacturing Company had a large contingent on the ground, consisting of Messrs. Albert Schmid, E. H. Heinrichs, C. A. Bragg, George H. Lewars, E. L. Sanderson, A. J. Craigin, B. F. Stewart, R. S. Brown, J. A. Rutherford and E. F. Gordon. The company's headquarters were at the Queen's Hotel, and a fine collection of photographs illustrating the Westinghouse apparatus was displayed in Room 304 of the Windsor. The company had a practical exhibit in the shape of a car equipment on Montreal Street Railway car No. 55.

The Fiberite Company, of Mechanicville, N. Y., had one of the most attractive exhibits in the Rink, consisting of a full line of trolley wire hangers, strain insulators, frogs and cross-overs, insulated with the well-known Medbery material. The company also exhibited a line of station switches and waterproof sockets. Particular interest was attached to this exhibit on account of the fact that all the electric railway system in Montreal is equipped with material manufactured by the Fiberite Company and the Mason Electric Equipment Company, of Chicago. Messrs. H. J. Medbery and W. R. Mason were on hand and made their opportunities tell.

The Mica Insulator Company, of New York, had an interesting exhibit over which was a striking sign consisting of a large sheet of micanite bearing the name of the company and liberally illuminated by incandescent lamps. Commutator segments and rings of micanite, micanite cloth and paper and micanite in innumerable forms were included in the exhibit, two features of which were representations of a W. P. motor armature and a large generator commutator insulated entirely with micanite. Eugene Munsell & Company occupied the same space and exhibited mica cut to size in every practical shape. Both companies were represented by Mr. Charles E. Coleman.

George S. Whyte, of Chicago, presided over the exhibits of the Chicago Insulated Wire Company, of Chicago, and the Badger Manufacturing Company, of Milwaukee. The former company had an extensive exhibit of bare and insulated copper wire ranging in size from stranded feeder cables of 500,000 circular mils to No. 35 B. & S. magnet wire. The Badger Company displayed a complete line of overhead railway material, fuse-blocks, rail bonds, etc. Mr. Whyte distributed most useful souvenirs in the shape of miniature Badger trolley hanger bells for paper weights, and also gave away small spools of No. 35 magnet wire and hand-books of facts and figures for electric railway linemen.

The Okonite Company, of New York, was represented, of course, by Capt. Willard L. Candee, who strengthened the company's hold upon the trade at large in his customary effective manner. The company is distributing copies of an interesting pamphlet containing in full Prof. J. A. Fleming's report on Okonite insulation, which is exceedingly favorable. The insulation was subjected to severe tests and the opinion expressed by Prof. Fleming is as follows: "I consider that the behavior of these samples of Okonite cable place it in the first rank as a class of cable for electric lighting and transmission work." Gratifying testimonials from Lord Kelvin and Dr. John Hopkinson are also printed in the pamphlet. Commendation from men of such standing is unequivocal and cannot fail to have proper weight with users of insulated wires and cables.

Standardizing Incandescent Lamps.

BY R. E. RICHARDSON.

It appears to the writer that at this day the most uncertain problem which the manufacturer, consumer and engineer has to dea with in the electrical line is the candle-power of the incandescent lamp, this uncertainty arising from the confusion or lack of uniformity in the standard lamp for testing, and also from the fact that the manufacturers have never come to any agreement as to what is to constitute a 16-cp incandescent lamp. What we propose to say on the subject relates to 16-cp lamps, but naturally, if the argument holds good in this case, it will with lamps of 8, 10, 16, 20 or any cp.

With the amount of capital invested by incandescent lamp manufacturers, with the earnest endeavor shown by them in their expenditures of money, time and talent to produce and place on the market a lamp of high efficiency, long life, uniformity in candle-power and a high average in maintenance of candle-power, is there not a demand for a universal standard from or to which all manufacturers shall work before we can tell what is meant by a standard 16-cp lamp? Many men may answer, all *do* work to the same standard. Undoubtedly they honestly think they do, but our experience in testing the standards furnished us by scientific institutions and lamp manufacturers, and in testing of the so-called 16-cp commercial lamps of almost every make in this country, leads us to believe that there is a wide difference in standards, as no two gotten from different sources agree, and further, the so-called 16-cp lamps vary when new from 10 to 22-cp. We are confronted with two uncertain, or, more properly speaking, variable difficulties: 1st, the "standard lamp"; and second, what the lamp manufacturer means by a "16-cp lamp"; that is, does the candle-power marked on a lamp indicate its mean, its maximum, or its minimum horizontal candle-power.

Let us first take up the question of the standard lamp. The writer has interviewed several lamp manufacturers on this subject, and in every case they have complained of this irregularity in standards. It seems to us, and to some of the manufacturers, that a solution of this problem would be to have a bureau established by, for instance, the National Electric Light Association, the American Society of Electrical Engineers, or by an association formed of the lamp manufacturers, the object of which shall be to furnish standards to all lamp manufacturers or engineers doing photometric work. So-called standard gas flame lamps are made, but these lamps are standardized with gas of a certain richness. They are unreliable, as the pressure and quality of gas is one thing in one city and quite another thing in another, and even in the same city there is often a wide variation in candle-power. Standardizing with standard sperm candles is a difficult and most unsatisfactory proceeding, even when the greatest care is taken and the candles are carefully weighed. What, therefore, can we get for a reliable standard?

If some such bureau as before referred to was created and it should adopt an oil burner, with screen, and furnish such lamps, with standard oil, to all lamp manufacturers, engineers, etc., we would then all be working to the same standard. This would do away with the wide variance existing to-day, and quick, accurate and comparative tests could be made of the lamps which are placed on the market. Too little attention has been paid to the question of standards by both lamp manufacturer and consumer. The consumer, for instance, asks for a 50-watt lamp. His order is filled and he can quickly make a test and find out if a 50-watt lamp has been furnished him. But what do these 50 watts of energy represent? Does his lamp give 12, 14, 16, 18 cp, or wot t'ell, as Chimmie Fadden would undoubtedly say. The purchaser does not know whether he is using a lamp consuming over four watts to the candle-power or under three, and this difference is of no small moment when the questions of fuel and investment are considered. It means a difference of over 25 per cent. in his fuel bill for the production of a given quantity of light, and necessitates a corresponding increase in the capacity of his plant. Reputable lamp manufacturers are thus at as great a disadvantage as the consumer. The manufacturer of cheap, low-efficiency uniform lamps reaps the harvest at the expense of the honest manufacturer and of the consumer. The dynamo manufacturer guarantees the efficiency and regulation of his apparatus; the transformer manufacturer the efficiency and regulation of *his* apparatus; even the wire manufacturer guarantees the conductivity and insulation of his wire. Tests to prove or disprove their guarantees are easily made. But how can we test the 16-cp lamp? Is the candle-power marked on the lamp its mean, its maximum, or its minimum horizontal candle-power? As it is impracticable for manufacturers to take but one reading of each lamp, there should for each type of lamp be adopted some fixed position of the filament when testing. This, for example, might be determined as follows:

After obtaining the mean horizontal candle-power for a lamp with a given type of filament, a position could be found which would give the same candle-power. This position would correspond very closely to a certain angle between the plane of the leading-in wires and the photometer scale.

The uncertainty of the standard employed was brought very clearly to our notice a short time ago. Two barrels of the same shipment of lamps were sent to two large central stations in adjoining cities. It so happened that both companies paid considerable attention to the lamp question, and made efficiency and photometric tests to see if the lamps furnished came up to the manufacturers' guarantee. In one case the purchaser complained that they averaged about one and one half to two cp above 16, and the other that they ran from one to two cp too low. We have no reason to believe that the readings on the photometric scale were not correct taking the standards they used, and the filament at an uncertain angle. The trouble undoubtedly was that their standards or the filament angles varied, or both. Again, the lamp manufacturer probably had still a third standard and a third angle of filament. His only recourse was to state that if the consumer would furnish him with what he, the consumer, called a 16-cp lamp, and would state what angle the filament made with the photometer scale, when readings were taken he would use *that* as a standard when filling his individual order. Assume that a uniform standard were adopted, and a means provided by which any one could obtain it from an absolutely reliable source, and that the angle of the filament for the various types of lamps were decided upon, we now would be in a position, lamp manufacturers, consumers, engineers and all, to make accurate, fair and impartial tests.

There would, however, still be one other point which should also be agreed upon, namely, What shall constitute or pass as a 16-cp lamp, that is, what margin or variation in candle-power are we to allow? We cannot fairly ask lamp manufacturers to make every so-called 16-cp lamp of exactly 16 cp, and, therefore, what shall constitute the allowable variation in candle-power? Any one who has paid much attention to photometric work knows that uniformity in candle-power in our present lamp is, in many cases, an unknown and apparently unsought-for condition by manufacturers. Let us adopt for a 16-cp lamp a range of, say, a candle above or below 16 candles for our permissible variation, that is, a limit of 2 cp.

Such a course will, or ought to be, a deathblow to the manufacturers of *cheap* lamps, which are the most expensive lamps the consumer can buy. Some lamp manufacturers build excellent lamps, but do not standardize them carefully, making all lamps varying from 106 to 114 volts—110 volts. While these lamps may be excellent ones if operated at their normal voltage, it is very evident that there would be a great difference in candle-power life and efficiency if all were operated at 110-volt pressure. The results desired can only be obtained or brought about by the co-operation of the consumer and manufacturer, and with the aid of a standard which the consumer should be able to get as readily as the engineer or manufacturer. With such a standard and a clear understanding as to what is to constitute a 16-cp, 10-cp, or any lamp of any other rating, a simple photometer can be an adjunct of every well-regulated plant, isolated or central station; quick and satisfactory comparative or standardizing tests can be made as to the candle-power, and with a voltmeter and millimeter, or with a wattmeter, the energy consumed can be determined. The same tests can again be made by the consumer after he has used some of these lamps 200, 400, 600 or any number of hours, and he thus can determine not only the initial efficiency of his lamp, but can also find out how well the candle-power holds up after a few hundred hours' service.

When that time comes the manufacturer of cheap lamps will disappear from the face of the earth. The reputable manufacturer can go on aiming to improve and give to the consumer a better lamp, and he will not have to be devoting most of his energies in trying to compete in price with an inferior, if not worthless, article. The consumer would be equally benefited, for while he may not be able to buy lamps at as low a price as he can to-day, his lamps will in reality be cheaper; for close competition will remain, and he will get, at a fair price, a lamp which will give him a full and well-maintained candle-power and longer life for a minimum amount of energy expended in producing the same, and not be buying cheap lamps, which in many cases would be dear for him to use if furnished free of charge.

The Invention of the Electromagnetic Telegraph—VII.

BY STEPHEN VAIL.

From a pamphlet prepared by S. F. B. Morse in 1853, which was soon after reprinted by him in Paris, I quote the following:

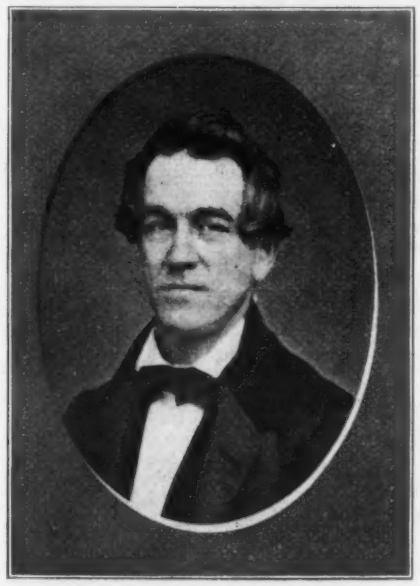
"Alfred Vail, being then (1837) a student in the New York City University, and a young man of great ingenuity, having heard of my invention was naturally desirous of seeing it as it then existed in my rooms in the University. In the Summer of that year he came to my rooms, and I explained it to him, and from that moment to the present (1853) he has taken the deepest interest in the telegraph.

"Finding that I was unable to command the means to bring my invention properly before the public, and believing that he could command these means through his father and brother, he expressed this belief to me, and I at once made such an arrangement with him as to secure the pecuniary means and the skill of these gentlemen. It is to their joint liberality, *but especially to the attention and skill, and faith in the final success of the enterprise maintained by Alfred Vail that is due the success of my endeavors to bring the telegraph at that time creditably before the public.*

"He was with me assisting me with its construction, in its first exhibitions to the New York public in 1837, to the Franklin Institute in Philadelphia, and to Congress in 1838; *and, from his peculiar experience in all that relates to the invention,* was appointed my assistant superintendent on the passage of the Telegraph Bill in 1843."

Securing a contract with one whose conscience was his guide in all that he did, Morse, when Alfred Vail became his partner in the patent of the electric telegraph, obtained an ally to whose intelligence, mechanical skill and inventive ability were added absolute integrity and the most scrupulous conscientiousness of character, and to these conditions may be attributed the fact that the world knows but one name in connection with the invention.

All familiar with the history of the telegraph from the time of its first practical success as a public servant, know that litigation with reference to infringements extensively involved the patentees, and occupied a large part of their time as well as money; and, too, that these lawsuits continued up to the expiration of the patents. One of the "fortunate" conditions for Morse was that Alfred Vail passed from earth while these contests were being prosecuted. It needs no argument to show that, no matter how much the latter may have contributed to the patent, prudence and interest demanded that Alfred Vail stifle the conviction (which had gradually come to him before and during this period of litigation), that his identity was being eliminated from the invention by Morse, whose name was the only one mentioned in connection with the system that had proved so undoubted a success.



ALFRED VAIL.

Mr. George H. Stockbridge has written in this connection thus:

"When Vail had once committed himself to the new work (in 1837), his devotion to it assumed the character of a passion. The sprout planted by Morse had sprung up in the young man's mind as an independent growth equal in vigor and strength to the original tree. If the conception had had its birth with Vail, he could not have taken more interest in its development. The elation and depression which alternated in his mind from time to time were intensely personal. It is doubtful if the history of these months, while Vail and young Baxter, a confidential assistant, were at work in their locked room at Speedwell, can be adequately explained except upon the hypothesis that the successes and failures were Vail's and not Morse's. The gradually changing relations of the two men, Vail's undefined feeling, which finally grew into expression, that Morse had not given him due public credit for his services, tell a story of natural jealously on Morse's part, and of an outraged sense of justice on Vail's part, which, not having received its proper comedy *denouement* in a generous acknowledgement from Morse, has lately risen to do poetic justice of the retributive sort by exposing Morse's misdemeanor."

In a report made by a select committee from the board of regents of the Smithsonian Institution at Washington, appointed to examine fully into imputations cast upon Prof. Henry by Prof. Morse (*vide* report for 1857), appears the following:

"It thus appears both from Prof. Morse's own admission down to 1848, and from the testimony of others most familiar with the facts, that Prof. Henry discovered the law or 'principle' as Morse designates it, which was necessary to make the practical working of the electromagnetic telegraph, at considerable distances, possible; that Morse was first informed of this discovery by Dr. Gale; that he availed himself of it at once, and that it never occurred to Morse to deny this fact until 1848. He had steadily and fully acknowledged the merits and genius of Henry as the discoverer of facts and laws in science of the highest importance in the success of his long-cherished invention of a magnetic telegraph. Henry was the discoverer of a principle, Morse was the inventor of a machine, the object of which was to record characters at a distance to convey intelligence; in other words, to carry into execution the idea of an electric telegraph. But there were obstacles in the way which he could not overcome until he learned the discoveries of Henry, and applied them to his machine. These facts are undeniable. They constitute a part of the history of science and invention. If they were true in 1848, they were equally true in 1855, when Prof. Morse's article was published. What changed Morse's opinion of Henry, not only as a scientific investigator, but as a man of integrity, after the admission of his indebtedness to his researches and the oft-repeated expressions of warm personal regard? It appears that Morse was involved in a number of lawsuits, growing out of contested claims to the right of using electricity for telegraphic purposes. The circumstances under which Henry, as a well-known investigator in this department of physics, was summoned by one of the parties to testify, have already been stated. The testimony of Henry, while supporting the claims of Morse as the inventor of an admirable invention, denied to him the additional merit of being a discoverer of new facts or laws of nature, and to this extent perhaps was considered unfavorable to some part of the claim of Morse to an *exclusive* right to employ the electromagnet for telegraphic purposes."

In the same Smithsonian report alluded to, the writer thereof, Prof. W. B. Taylor, thus alludes to Morse's claim to being the inventor of the system which bears his name:

"It is not a little remarkable, however, that, of the specified six parts of this earliest invention of Prof. Morse, *not one* enters into the established Morse telegraph of to-day. That feature regarded by the inventor as its vital and fundamental characteristic (the fourth), the subject of his former 'claim,' survived the longest; but, after undergoing considerable modification, it has, for more than 20 years, been neglected and abandoned. It should not be forgotten that the vertical recording lever of the original Morse apparatus was so arranged that it must necessarily mark a continuous line, either straight or zigzag. It was never devised for an alphabet, and was incapable of an intermittent dot-and-dash marking. The new instrument completed by Mr. Vail, and first operated on the 6th of January, 1838, was differently organized, the recording lever being, for the first time, arranged horizontally and having an up-and-down movement, with an upright magnet under one end and the moving fillet of paper above the other.

"It appears, from various convincing testimonies, that the new recording instrument, constructed for Prof. Morse by Mr. Vail, during October, November and December, 1837, was entirely of his own design, without any suggestion from Prof. Morse, and that its arrangement for discontinuous marking was specially contrived, by its maker, for an alphabet exclusively devised by himself, which he abstained from publicly claiming, owing to a delicate sense of obligation, incurred by his contract with Prof. Morse, to render him every assistance in perfecting the mechanical arrangements of the telegraph.

"That Prof. Morse had no conception, on the 3d of October, 1837, of the form of instrument contemplated by Mr. Vail, is clearly shown by the autographic 'caveat' of that date, and the following extract from a letter written by the former to Mr. Vail, and dated—'New York University, Oct. 19, 1837.'—'I long to see the machine you have been making, and the one you have been maturing in the studio of your brain . . .' would seem to clearly establish the fact of Morse's ignorance of the work upon which Alfred Vail was alone engaged.

"And his letter to Mr. Vail, of October 24, announcing the completion of the numbered dictionary (in which he wrote, 'We can now take or write anything by numbers') is equally conclusive evidence that, at this later date, he was still unconscious of any alphabetic arrangement."

My father states in his work upon the telegraph that this conventional alphabet (dots and dashes) was "*originated*" on board the packet *Sully*, by Prof. Morse. It was on the *Sully* that Morse devised the plan, later followed out in his wooden apparatus, of a continuous zigzag line, and that device was used for months after Alfred Vail had become connected with the invention. This movement, as before mentioned, was of necessity the basis of any other results in the way of marking that might be obtained from the action of the magnet, and it is, therefore, very easily understood why, under the circumstances of his contract with Morse and his peculiarly strict construction of its terms, he could state that an alphabet, *entirely of his own discovery*, but, *of necessity*, based upon the lines

of Morse's zigzag movement, was "conventional" and "originated" with Morse. He does *not* state that Morse "*invented*" it, as Mr. Jones and Mr. Tanner, in their articles, assert he did. He did not claim it, being debarred from doing so (as he states with reference to the embossing mechanism) "because I wished to preserve the peaceful unity of the invention, and because I could not, according to my contract with Prof. Morse, have gotten a patent for it."

As the action of the magnet is limited to producing but one movement when under the influence of the electric current—that of drawing an armature to it (the reverse movement of that armature being obtained by some other power, such as a spring to draw it away, upon the electric circuit being cut off from the magnet)—it follows that the only motions possible in that armature are either vertical or horizontal, and if the latter, and a marking device is in use, a continuous line, either straight or zigzag, must result. If the movement is vertical, a separation of that straight line into dots, dashes and spaces, in accordance with the character of the continuity of the current, must ensue.

Mr. Jones in his article of this series has this passage:

"It will be seen that in the Morristown experiment, Jan. 11, 1858, the Morse numerical code and dictionary were used and the signals recorded on the new register constructed by Vail, and in the New York experiment, 18 days later, with the same apparatus, the dot-and-dash code without a dictionary was employed, so that there is no ground for believing that the register was constructed by Vail to meet any changes he may have proposed in the Morse numerical code."

Mr. Jones overlooks the fact that the wooden apparatus of Morse was, as early as the latter part of September, 1837, taken to Speedwell and work upon its change at once begun by Mr. Vail, culminating early in January in a register constructed to produce, not only a vertical movement of the pendulum arm in connection with the portrule and type, but to produce marks by pencil of a numerical character; that is, dots and dashes, singly or in groups (instead of the continuous zigzag line and V points as produced by Morse's apparatus) corresponding in appearance with the type used in the portrule to open and close the circuit.

It will be readily seen that this vertical movement of the armature must of necessity have been used, when, 18 days later, the dot-and-dash alphabet in type was used in the New York experiment or exhibition, and that the new register was adapted to either Morse's numerical writing or Alfred Vail's dot-and-dash alphabet.

That Morse claimed this dot-and-dash alphabet as his own invention is not at all surprising, for there is unquestioned evidence that he did claim the invention of Alfred Vail of the grooved roller and steel stylus, producing an indentation upon the paper of the dots and dashes in his patent (as reissued) April 11, 1846, in the plainest terms, as follows:

"Third. *I* also claim as *my* invention the combination of the pen and pen-lever, or its equivalent with the grooved roller," etc., and he made solemn oath that he "believed himself to be the *original and first inventor of this combination.*" On many other occasions, knowing full well that Alfred Vail was the sole inventor of this embossed writing, he also claimed it as his own.

Hon. F. O. J. Smith, one of the partners in the original patent of Morse (having had, as capitalist and business manager, a one-fourth interest in the enterprise), has also stated in a published letter, dated March 30, 1872, that the horizontal lever adapted to emboss the alphabetic characters "was neither invented nor combined in the telegraph by Prof. Morse, but *exclusively by our associate, Mr. Alfred Vail;* although for reasons that will be satisfactory to most minds, they were never publicly credited to him, but have been claimed exclusively by Prof. Morse as his own invented combination."

In the New York *Times* of Aug. 25, 1883, appeared a communication signed "Investigator," written by a gentleman of high attainments and deep research, in which were the following statements:

"I have somewhere among my papers carefully laid away, the first form of a letter written in his own hand, by Prof. Morse himself, to the British Attorney-General, who is, or was, ex-officio, the Patent Commissioner of Great Britain in 1844, or perhaps 1843 (which letter, Morse in order to make his claims intelligible to the man whom he thought to be thick-headed, but who was very sagacious, and happened to know too much for Morse, as the sequel proved) commenced with a series of disclaimers—stating that he did not invent this or that; and he concluded the letter with claiming to have invented only two things which he wished recognized as his, to wit: First, a mechanical means of making marks upon paper—I forget the name, and it was of no practical account; and second, the sending of a communication over a single wire. This was Morse's strong point, and even it was not his actual discovery, but it was accorded to him through a legal conclusion in the construing of a contract which existed between him as the one party and Prof. Gale and Alfred Vail as the other party.

"There are other facts which go to show that the 'Morse Telegraph' is not Morse's invention, and that the late United States Judge Levi Woodbury, Hon. Salmon Chase, and several other distinguished gentlemen, at various times engaged in 'telegraph suits,' all know that Morse's claim to the invention was but a shadow, at best, and I had the confirmation direct from the lips of the late Hon. F. O. J. Smith, that at one time during the trial of the celebrated case of F. O. J. Smith vs. Hugh Downing, before Judges Woodbury and Sprague, in the District of Massachusetts, in 1850, he (Smith) trembled lest the facts in the case be exposed, so near did the opposing counsel chance to get at the thing; but, fortunately for him, the ignorance of the eminent counsel of the science of telegraphy of that time was such that a dangerous question, the real merits of which the counsel putting it did not comprehend (and put to Prof. Morse himself, I think) was skillfully parried by an 'objection' from the other side and a shrewd argument thereon ensued, by which the counsel were 'obfuscated.' The counsel never suspected how near they came to catching the weasel. This means simply that Mr. Smith's case so saved, saved Prof. Morse's reputation and claims for that time."

Morse, in his sworn testimony before the court in Philadelphia, in the case of French et al. *vs.* Rogers et al., in reply to numerous questions of defendant's counsel, disclaimed being "the inventor of the electromagnet," "the discoverer that the electromagnet will attract an armature of steel or iron;" or "the first inventor of the combination of an electromagnet with a circuit of conductors." He disclaimed being "the first to discover that the breaking or closing of an electric or galvanic circuit having within it a generator of electricity or galvanism, would cause an alternate flow and cessation of a current of electricity or galvanism." He disclaimed being "the first to discover that when an electromagnet is connected with and forms part of such circuit, the magnet will be made attractive and non-attractive as the current flows or ceases to flow."

He disclaimed being "the first inventor of an apparatus consisting of a galvanic battery, or other generator of electricity or galvanism, a metallic circuit of electric or galvanic conductors, an electromagnet with an armature and a device for closing or breaking such circuit, or that he was the inventor of the combination generally, or of any of its parts in the abstract," but he did claim that he was "the first inventor of the combination of these parts as described in my patent and used in my telegraph."

In September, 1837, Morse entered into a partnership contract* with Alfred Vail (a recent graduate from the University of the City of New York, in which institution Morse was a professor), by the terms of which contract, he (Vail) was not only to become a financial partner, because of the money he provided, but was to devote his talents and scientific ability to the improvement and development of the invention. He was also to furnish all the means necessary for experiments, to take out patents and exhibit the invention before a committee from Congress.

It is believed by the writer of this article that this is the first time that the contract above referred to has ever appeared in public print, and its contents ought to convince the most skeptical as to Alfred Vail's great part in the eventual production of a successful and practical commercial system, that he had something more to do with this great triumph than that of an employee who "had hired himself at three dollars per day," as is so positively asserted by Mr. J. D. Reid and cited in the article of Mr. F. W. Jones.

It would be interesting, too, to ascertain who it was that paid the alleged three dollars per day—certainly not Morse, in his poverty-stricken condition.

Alfred Vail lived up to the spirit no less than the letter of that contract, as he believed he, in his character as a Christian gentleman, should do, and to this fact is due the other fact that Morse (who never evinced the slightest hesitancy in accepting, but, on the contrary, claimed it) has been accorded the fame and renown of an invention of which, instead of being the inventor, he was but the instigator. Alfred Vail believed that his contract with Morse so fully covered everything that *he* might accomplish in the development and improvement of the telegraph, that, notwithstanding he felt compelled to cast Morse's crude original instrument and its cumbersome vocabulary entirely away, and then made the new *recording receiver, sounding-key* and *dot-and-dash alphabet*—he considered that it was but his duty by his understanding of the terms of the contract, and that to Morse belonged all that he had done.

It is difficult, I know, in this day of greed and fraud, to understand the characteristics of a nature that could and did sink self absolutely, and because of an over-conscientious conviction that it

* See following page for text of contract.

was his duty, consent to have bestowed upon his friend and copartner *all* of the praise and honor that jointly belonged to himself. Contrast the two characters, one all honesty and sincerity, the other willing to take advantage of that nobility of mind and person. Is this language too strong to use in describing Morse, who never had, either during the lifetime of Alfred Vail, or after his death, the common (or perhaps uncommon) honesty or generosity to recognize the true part taken by the man who gave him, not only material aid when he could not obtain it elsewhere, but abandoned the study of the profession he had decided upon following that he might devote his mind and energies to the task of making the embryo telegraph a practical living success.

Not only this, but he took the poverty-stricken Morse into the bosom of his father's family, gave him a home, fed him, and for aught I know, clothed him during that historic period from September, 1837, to February, 1838. All this at no cost to Morse beyond the painting of the portraits of Judge and Mrs. Stephen Vail, the father and mother of Alfred Vail.

During the period mentioned, Alfred Vail, in the effort to make a practical success of Morse's wooden machine and cumbersome vocabulary, found it absolutely necessary to discard the entire apparatus and devise a new system (which he did, unaided by Morse), resulting in the production of that which has ever since been known as the "Morse Telegraph," the reasons for which have been set forth in a previous part of this article. Suffice it to say, in the words of the late Mr. Franklin L. Pope: "The essential telegraph of to-day, and the universal telegraph of the future, comprises *solely* the work of *Joseph Henry* and *Alfred Vail*." And why not—for did not Joseph Henry invent the practical electromagnet, and Alfred Vail the sounder (or receiving recorder), the key and the dot-and-dash alphabet? As these elements, together with a wire and an electric current, neither of which Morse ever claimed to have invented (so far as I am informed), what was left for him to contribute, but the suggestion embodied in his now discarded wooden apparatus?

History, at least that history with which I am familiar, does not show an instance of so profound an absorption, by one individual to his own benefit and world-wide fame, of the results of the untiring energy and active brain of another, his benefactor and friend, and, too, with his consent, as is to be found in the complete and thorough manner in which Morse took to himself all of the credit and renown of the invention, in the ultimate success of which he had so little to do.

Alfred Vail lived long enough to regret deeply that he had subjugated to another his part in the greatest invention the world has ever known, through a mistaken belief in his obligations to Morse under the terms of the contract with him, and he quietly but feelingly showed to his family and friends, the astonishment he felt upon finding Morse so loth to share with him even a small part of the fame that was given to him. Notwithstanding all this, he never lost faith in the belief as he so often said: "I am confident that Prof. Morse will yet do me justice."

(*To be continued.*)

* Copy of an agreement between Samuel F. B. Morse and Alfred Vail, dated September 23, 1837:

Articles of agreement made this 23d day of September, in the year of our Lord, one thousand eight hundred and thirty-seven, between Prof. Samuel F. B. Morse, of the University of the City of New York, in the City and County and State of New York, of the first part, and Alfred Vail, of Speedwell (Morristown), in the Township and County of Morris, and State of New Jersey, of the second part, as follows, to wit, viz.:

Whereas the said Samuel F. B. Morse, of the first part, has invented a new machine for the transmission of intelligence, called the "Electromagnetic Telegraph," and to secure to himself the benefits of his invention, he is preparing to take out letters-patent of the United States, and he hereby associates himself with the party of the second part in this undertaking, upon the following terms and conditions:

First. The party of the second part covenants to construct and to put into successful operation, *at his own proper cost and expense*, one of the telegraphs of the plan and invention of the party of the first part, and to exhibit its full power and value before a committee of the Congress of the United States, on or before the 1st of January, eighteen hundred and thirty-eight.

Second. All expenses, which in the judgment of both parties, shall necessarily be incident to the final completion and perfection of the said plan of telegraphic communication, shall be defrayed by the said Vail, of the second part, *who also agrees to devote his time and personal services faithfully to this object without charge.* The expenses of obtaining letters-patent from the United States, are intended to be included as a part of the incidental expences, as well as all machinery and apparatus which may be found to be necessary for testing, by actual and speedy experiment, the efficiency of the mode of transmitting intelligence.

Third. And it is hereby further agreed between the said parties of the first and second parts, that, in case either of them shall make any new discoveries which will be applicable to said telegraph, or any new invention which will tend toward perfecting the same in any manner, he will, as soon as practicable, communicate the same to the other, and it shall be held as the property of each, in the same proportion as their respective rights in the whole, and the expenses of taking out letters-patent for such new discovery or invention, if such letters-patent be mutually thought to be necessary, shall be defrayed by each, in the same proportion as he holds of the whole, by these presents hereinafter mentioned.

Fourth. In consideration of the aforesaid payment of money (mentioned in Article 2, of this agreement), and such other aids as are promised, and shall be undertaken and fulfilled by the said Vail, of the second part, the said Samuel F. B. Morse, of the first part. doth, hereby, assign, transfer and convey, to the said Alfred Vail, of the second part, and to his heirs and assigns forever, one equal undivided one fourth part of all his interests and rights, which he now holds, or which may accrue by means of the said invention of the "Electromagnetic Telegraph" and by the proposed patent to be secured to him as aforesaid, so far as any benefits and advantages may arise therefrom.

Fifth. It is also agreed by the said Morse of the first part, that, provided that said Vail of the second part will procure to be taken out letters-patent for this invention, in any or all of the foreign countries of the globe, he shall be entitled to one equal and undivided one-half of all the benefits, profits and advantages arising therefrom, and it is further agreed by said party of the second part, that the said letters-patent for the exclusive right to use such invention of the "Electromagnetic Telegraph" in France, England, Scotland and Ireland shall be taken out in any or all of these countries with the least possible delay, and as soon as the models necessary for that purpose shall be sufficiently completed to test their efficiency, and that no unnecessary delay be incurred, these models shall be immediately commenced, as provided for in Article 2 of this agreement.

Sixth. In event of the entire failure of the aforesaid invention, and its abandonment by the parties to this covenant, it is mutually agreed that all the machinery, apparatus, etc., made since the date of this agreement shall be the exclusive property of the said Vail.

Seventh. It is further agreed by the said party of the second part, that the letters-patent taken out for France, England, Scotland and Ireland, in compliance with Article fifth, *shall be taken out in the name* and for the exclusive benefit *of said Morse*, of the first part, and it is hereby agreed by the said party of the first part, that, as soon as he has obtained them, he shall immediately assign, transfer and convey to the said party of the second part, one equal undivided one-half of all his interest and rights by said letters-patent secured to him.

In testimony whereof we have hereunto set our names and seals.

In the presence of
E. O. MARTIN,
ROBERT BOYLE.

SAMUEL F. B. MORSE.
ALFRED VAIL.

Prizes for Engineering Papers.

The English Institution of Civil Engineers invites papers on engineering subjects, in competition for a number of premiums arising from special funds bequeathed to it for the purpose. In a recent circular a list of 66 subjects is given, including the following relating to electricity: "The Extraction of Metals from Their Ores by Electrolytic Processes"; "The Use of Electrical Machinery for Lighting and the Transmission of Power in War Ships and in the Mercantile Marine"; "The Most Suitable Steam Power Equipments for Electric Light Stations"; "The Utilization of Electric Lighting Plants during Hours of Small Demand"; "The Utilization of Electrical Energy in Form of Heat"; "The Regulation of Electric Pressure in Large Lighting Circuits as Carried Out at the Engine, the Dynamo, or the Exciter"; "The Theory and Practice of the Transmission of Power by Alternating Currents"; "The Use of Electrical Motors for Driving Machines in Textile Factories and in Engineering Workshops"; "The First Cost, Facility and Economy of Operation of Electrical Traction on Railways with Heavy Trains and on Tramways"; "The Construction and Working of Electrical Lifts and Cranes"; "The Electrolytic Action of Return Currents in Electrical Tramways on Gas and Water Mains, and the Best Means of Providing against Electrical Disturbances."

Papers should be addressed to James Forrest, Esq., secretary Institution of Civil Engineers, Great George Street, London, England.

Tesla Patents in Europe.

Messrs. Schneider & Co., of Creuzot, who control in France the Tesla rotary field patents, have instituted proceedings against Messrs. Weyher & Richemond, manufacturers of the Brown motors; Messrs. Guitton & Bertolus, who manufacture the Oerlikon motors; M. Joly, the representative of M. Alioth, and the Société Grenobloise, for alleged infringement of patents. In Germany, the Actiengesellschaft Helios, of Cologne, possesses the Tesla rights, and it has followed a similar course.

DIGEST OF CURRENT TECHNICAL ELECTRICAL LITERATURE
BY CARL HERING
COMPILED FROM THE PRINCIPAL FOREIGN AND AMERICAN JOURNALS

DYNAMOS, MOTORS AND TRANSFORMERS.

Compounding Dynamos by Armature Reaction.—Prof. Elihu Thomson in the Lond. "Elec. Rev.," Oct. 4, calls attention to the recent comments of Mr. Sayers, which were abstracted in the Digest, Sept. 21, and in which, he says, Mr. Sayers has unwittingly made the mistake of supposing that Thomson did not regard the breaking down under heavy loads as due to the magneto motive of the armature overpowering the effect of the wound poles. He believes Sayers failed to notice certain statements in his (Thomson's) paper regarding Figs. 11 and 12, in which it was said that "the former shows how completely the wound pole has been broken down by armature reaction, and how the unwound poles have now become the chief working field poles, or rather how armature winding itself has furnished the field for its own cutting." Mr. Sayers interpreted another statement by concluding that if the excitation of the wound poles were to be dispensed with, the effective flux would vanish and the machine become inoperative, to which Thomson replies that there is surely a difference between dispensing with the wound poles and dispensing with the excitation of those poles, leaving the poles in position. All of Mr. Sayers' reasoning based on this misconception fails of being to the point.

Graphical Theory of Multiphase Motors.—The "Elek. Zeit.," Oct. 3, contains a communication from Mr. Heyland in which he discusses more particularly the relation between the current at full load and that at no load. He believes to have shown that it is not satisfactory to base the calculations of multiphase motors on two fundamental principles, but that theory and practice must go hand in hand.

Cup Armature Dynamo.—In the "West. Elec.," Oct. 19, Dr. Zahn gives a brief illustrated description of the new form of the Fritsche (Berlin) dynamo, the armature of which is in the form of a cup. The planes of the lamination of the usual armature cores are parallel to the direction of rotation, but in this one the lamination is "rectangular to the motion," which is claimed to be an improvement in many ways; its construction is very simple, but the description is not very clear; it consists of a solid hub of cast iron and a number of iron bars of peculiar form held together by the hub and thoroughly insulated from each other, with intervals between them containing the copper windings; the coils are wound separately on a former and are all alike; the field magnets are made in two parts, the outside being cup-shaped and having 3 poles, while in the inside of the armature there are 3 other poles located, apparently, between the others, thus forming a 6-pole machine; there is only one exciting coil; "the direction of the magnetic lines through the magnets, the armature core and the armature conductors, is rectangular to the direction of rotation;" the efficiency is claimed to be very high and the speed may be made very low.

LIGHTS AND LIGHTING.

The Electric Arc.—A long installment of Mrs. Ayrton's serial (see Digest, Oct. 5, Aug. 24), is published in the Lond. "Elec.," Oct. 4. In an American paper by Messrs. Duncan, Rowland and Todd, it is stated that almost any results may be obtained by modifying the size and composition of the carbons (referring to the equations connecting the voltage with the current and length of arc), but this, she shows, from the results of their own experiments, is not the case, and that the form of the two equations connecting these variables is the same whatever be the size of the carbons and their compositions, as long as they are solid; the constants in the equation will, however, doubtless depend on the hardness of the carbons and perhaps on their size; she shows that her equation is really more in accordance with results of their own experiments than the equations which they themselves deduced from them. The laws upon which her equation is founded and upon which it depends absolutely are as follows: "1. The curves representing the connection between power and length of arc for various constant currents are straight lines. 2. The curves representing the connection between power and current for various constant lengths of arc are straight lines. 3. The straight lines representing the connection between power and length of arc for constant currents all meet at a point, both co-ordinates of which are negative. 4. The straight lines representing the connection between power and current for constant lengths of arc all meet at a point, both co-ordinates of which are negative." The greater part of the present portion of the article is devoted to showing that these laws are true not only for the results of her own experiments but also for the results of all other experiments of which detailed information has been published; among these are the results given in several American papers.

Small Arc Lamps.—The "Elek. Anz.," Oct. 3, gives some data concerning small arc lamps which have been introduced, during the past year, by a German firm. With a current of 1 ampere at 32 volts a candle-power of about 70 is obtained (whether this is the maximum or the mean spherical, is not stated, but presumably it is the former); the regulation is said to be very close. For such low-current lamps, as those for 1 to 3 amperes, the contact-feeding mechanism is claimed to be far preferable to clockwork, provided that the mechanism which feeds the carbon is constructed properly with respect to the magnet windings and the arrangement of the contact; in clockwork mechanism the feeding is done by the weight of the carbon holders, but in a contact lamp the carbons are forced together. An important difficulty encountered in small lamps is that the small carbons cannot readily be kept in line; in the present lamp there are guides a short distance above and below the arc which keep the carbons in line. In one installation 40 incandescent lamps taking 20 amperes and giving 640 candles were replaced with 5 pairs of arc lamps taking 2 amperes each, making a total of 10 amperes and giving a total light of 1,500 candles; with more than double the light, therefore, the current was halved, which represents a saving for the current of about 15 cts. per hour; the increased first cost of the arc lamps over the incandescent, therefore, is not appreciable in comparison, and the cost of the carbons is partly balanced by the cost of the renewals of the incandescent lamps. A modified system of connecting three lamps is shown and consists in having two in multiple arc and the third in series with these two; by that method three lamps of different candle-powers may be used.

"L'Energie Elec.," Oct. 1, publishes an illustrated description of a small arc lamp requiring 1.5 amperes and 35 volts which is said to give 75 candles; both carbons are fed, and the globe is quite small; they may be connected in series in any number.

Vacuum Pump.—An improved form of Rap's pump is described and illustrated in the "Elek. Anz.," Sept. 29; the improvements on the older forms are said to be quite material; the most important one enables the time for exhausting the bulbs to be greatly reduced; a space of about 400 cb. cm can be exhausted in five to six minutes down to a pressure of about .001 mm; in the present form the mercury can be made to flow rapidly without danger to the apparatus.

Costs of Different Illuminants.—See abstract under "Miscellaneous" on Acetylene.

POWER AND HEAT.

Worm Gearing.—Mr. Kolben in the "Elek. Zeit.," Oct. 3, in reply to the recent article of Mr. Egger (see Digest, Oct. 12) states that while 600 revolutions may give very good results, yet he believes to have shown in his previous article (see Digest, Sept. 14) that with a higher speed, as for instance double this, a proper construction of the apparatus, the results will be still better. The matter is of special importance in connection with single and multiphase motors; with 50 periods for instance and a five to eight-hp motor at 600 revolutions, such an elevator motor could not be used, as the motor would have to have 10 poles and the current at no load would be about double the watt current at full load; but with 1,500 revolutions and four poles the current at no load is small, the motor light and compact, and the efficiency of the worm and the motor very high; the apparatus will run noiselessly and it can be placed under the roof.

Soldering Iron.—A brief, illustrated description of the Wieczorezk electric soldering iron is published in the "Elek. Zeit.," Oct. 3. The point of the iron consists, as usual, of a block of copper which is held in the end of a tube, in which there is a carbon, whose position may be adjusted by hand; an arc is formed between this carbon and the inside end of the copper clock; in some cases a graphite block is fitted into the top of the copper block and can easily be replaced when worn out; according to the inventor the energy required is from four amperes at 25 volts to three amperes at 33 to 35 volts.

Electric Operation of a Canal Lock.—An illustrated description of the operation of the Canadian ship canal lock at Sault Ste. Marie is given in the "Elec. Eng.," Oct. 16; it is said to be the first time that electric power machinery was used for operating the gates and valves of canal locks, the principal advantage over the usual hydraulic machinery being that there is no trouble caused by frosts.

Los Angeles.—"Elec. Eng.," Oct. 16, states that a survey was recently begun for a transmission line 108.5 miles long, by which it is proposed to convey the power of the Kern River to Los Angeles; at first a transmission

of 10,000 hp is contemplated, with facilities to increase to four times this amount; no details are given.

TRACTION.

Combined Traction and Lighting Plants.—Lond. "Lightning," Oct. 3, contains a short article by Mr. Crompton in which he points out the advantages of combining the two plants. He states that if a thoroughly good underground system costing not more than $60,000 per mile of double track, can be constructed and operated with the same certainty as the overhead systems, there will be an enormous impulse given to electric traction in his country and he adds that he thinks he sees his way clear to carrying on such a system at that price. He considers it a move in the right direction to have the power supplied by lighting stations dividing the fixed expenses over the double output. Electrical energy can be produced continuously at a total cost of about one cent per kw-hour as the cost at the works, and an addition of one cent for administration, but this does not include the cost of distributing; it is for 24 hours a day but even for 18 hours, as would be required for traction, these figures would be nearly reached, the one cent for administration expenses, however, could be reached only by sharing these expenses with a lighting station; whenever the two stations can be combined, electric traction is sure to have an exceedingly brilliant future and the matter will be greatly simplified when the two plants become practically identical, the generators consisting of machines furnishing 450 to 550 volts and supplying the incandescent lamp circuits with 220 volts by the simple three-wire system; each supply would have its own mains and distributing system.

Economy of Overhead Traction.—Lond. "Lightning," Oct. 3, contains a short article by Mr. Dickinson. Regarding the construction he states that a thoroughly good and permanent way for overhead traction can be put down for $25,000 per mile, while an equally good conduit line cannot be laid for less than double this; in constructing a new line, therefore, the overhead system has much the advantage in point of cost, but when it concerns the question of converting an existing line the advantages are enormous. The permanent way (not including a new track) can be installed for about $7,500 per mile. He discusses adversely the statement made by Prof. Kennedy, that the efficiency of the electric motor was only 39 per cent. as against 70 per cent. for the steam locomotive.

Remedy for Electrolytic Corrosion.—Mr. Gray, in the Lond. "Elec. Rev.," Oct. 4, describes Mr. Farnham's system (see Digest, Aug. 31, see also Oct. 12), and states that in the Lond. "Elec. Rev.," June 21, 1895, page 772, a plan was described which differs from this one only in some points of detail (see Digest, July 13). He adds that Farnham's method of carrying it out is a long way from realizing the theoretical requirements of this system, and that a much better approximation would be attained by running a separate insulated wire from each section direct to the dynamo; the resistance of any of these wires could then be varied in the power-house when it was found that any section was deviating to a dangerous extent from zero potential; they might also be used to measure the potential of the section to which they were connected. If such a system is carried too far it might prove more costly than an insulated conductor in a conduit, but even if it cost as much, the cost of maintenance would probably be much less; but whatever the cost, the problem " will have to be solved or the business will have to be given up."

Surface Contact System.—The Diatto system is described and well illustrated in " L'Eclair. Elec.," Sept. 28. The car has secured to it a long bar of iron a few inches above the pavement, located in the middle between the tracks, running lengthwise with the car and of a length about equal to that of the car; this bar is magnetized by a number of electromagnets carried on the car; this bar slides over and makes contact with insulated metallic plugs inserted in the pavement between the tracks and at distances equal to a little less than the length of the bar, so that the bar always makes contact with the succeeding contact plug before leaving the next preceding. The lower end of these contact plugs is a short distance above a short, vertical, iron rod, which floats in a tube containing mercury, in contact with the mains; the magnetism of the bar on the car, acting through the contact plugs, attracts this iron rod causing a contact to be made with it, this contact being broken as soon as the magnetic attraction ceases. It is said that experiments which have been made on an experimental line during several months, have been successful even when the road was covered with mud and snow; the contact plugs are only slightly above the level of the pavement. The inventor estimates the cost of construction of a single line to be $3,400 to $4,800 per km, which the writer of the article considers much too low; the weight of the magnets of the contact bar is 440 pounds and the energy required for their excitation is 250 watts.

Record of an Electric Car.—The Lond. "Elec.," Oct. 4, states that a car of the Marseilles-St.Louis Railway covered a total mileage of 22,734 without any accident to the electric parts; the mean daily mileage was 96 and the maximum 129.5; the work of the cars is heavy, as there are steep grades and an enormous traffic; it is equipped with two 18-hp Oerlikon motors.

Hamburg.—A long, illustrated description of the trolley line in this city, which is one of the most extended lines in Europe, is published in the "Elek. Zeit.," Oct. 3; the system appears to be the same as those used in this country.

Prevention of Electrolysis.—The "Elec. Ry. Gaz.," Oct. 12, contains an anonymous article discussing the electrolysis of pipes. It is customary to search for electrolysis by means of a voltmeter, but many have not considered correctly the indications of such a reading; the rate of electrolytic action depends not on the voltage but on the current which is leaving the pipe; that is the pipe must be positive, hence a careful discrimination must be used in acting on the voltmeter indication in such work; one-half a volt in dry sandy soil does not represent one tenth the significance of a similar indication in moist ground. In order to intelligently apply a remedy, the case must be specially considered and the cause of its leaving a pipe must be determined, as also the place where the current goes after it leaves the pipe, as this may be a pipe that requires protection. He favors the suggestion of Mr. Brown (see Digest, Mar. 30) as far as it goes, but it only partially accomplishes the desired results, for while the current thus remains in the pipe more than it did before, yet it flows through it in a much greater quantity; electrolytic action may be set up at every joint. The things to be specially looked out for are enumerated and are briefly as follows: The current must be kept out of a jointed pipe at any cost on account of the joints; a continuous pipe may carry considerable current provided it does not leave at any but suitably prepared electrical joints; a current will choose the path of least resistance which may be of small cross-section but of very short length, a point which is often overlooked; for a continuous pipe all that is necessary is to look out for the points where the current leaves the pipe, as it is immaterial where it enters; finally, every case requires a special diagnosis and a special cure. Several examples are given; to keep a current out of jointed or any other pipes, wires must be connected to the rails at the points where the current would leave them, and should be run by the shortest possible distance back to the station.

Launches.—The "Elec. Eng.," Oct. 16, contains an illustrated article giving briefly some of the results of introducing electric launches in connection with electric railways, as an attraction at the pleasure resorts reached by these lines; the past year has shown that trolley roads are the best customers at present for electric launches and they find them a remarkably good source of profit; the relation of the income to the expense is far greater than that of trolley cars; it prophesies that the year 1896 will show a great increase in electric launches. In one case four launches ran a total of 1,750 trips at a total cost of 80 cts. per trip, while the year before this cost was $1.50 per trip; each boat is 30 feet long and carries 35 passengers. In another case each boat is fitted with 66 batteries charged in series from a trolley circuit, at 15 to 20 amperes and about 145 volts per boat; the boats on Jamaica Pond, Boston, are fitted with 52 batteries of 200 ampere-hours, the voltage being cut down by means of a water resistance; the six launches at the Atlanta exposition are fitted with 56 cells of the chloride accumulator of 175 ampere-hours each and the charging is done from an 85-volt, constant-potential circuit during the night; each boat requires 4 hp for less than 5 hours a day, and the average charge is from 35 to 40 amperes. Some illustrations of the motors and controllers are given, regulation being effected by various groupings of the batteries.

Long-Distance Transmission for Railways.—The "Eng. News," Oct. 17, referring to the Lowell plant, which was described in THE ELECTRICAL WORLD last week, estimates the probable percentage losses in each of the various transformations and transmissions. Calling the indicated power of the engines 100 per cent. it estimates the percentage losses as follows: engine friction 8, belting and shaft 10, dynamo 8, transformer 7, line to sub-station 12, transformers 7, rotary converter 16, railway circuit 10, car motors 15, leaving a remainder of 37.2 per cent. of the original indicated hp; it adds that electric railways for long-distance service must show better results than this before they can expect to handle trains or any considerable weight with reasonable economy.

Lenox Avenue Conduit System.—An editorial in "El'ty," Oct. 16, criticises the recent statement of Mr. Crimmins that the saving in operating expenses is four cts. per car mile, as compared with cable traction, and eight cts. per car mile, as compared with horses. It states that there is at present a drop in the line of 35 per cent. and adds that there are as yet no feed wires, but that they will be added; it then figures the cost of copper required in these feeders when all the 50 cars are in operation and finds it to be $162,518.40, which, added to an estimate of the cost per mile of the conduit, shows that the investment, excluding the motive power and rolling stock, is about $64,000 per mile of track from which is concluded that this settled in the negative the practicability of that kind of conduit road, the chief difficulty being in the low voltage which is 350 at the generator; the high cost of conduit is secondary to this.

Profits from Electric Railways.—An editorial in "El'ty," Oct. 16, endeavors to show "that the rapid development of the electric street railway business in America was based on a fallacy or rather on several fallacies;" it quotes at some length from the report of the Massachusetts Board of Railroad Commissioners, in which the question is discussed as to whether the electric system promises a larger return on the capital invested and thereby a possible future reduction of the charges for transportation; the true test of the net earning capacity of the horse and the

electric system is a comparison of the increase in the net earnings per mile with the increase in the cost of railway per mile, and applying this they find that, comparing the years 1888 and 1893, the net earnings per mile are 57 per cent. greater while the cost and capitalization per mile are respectively 60 and 65 per cent. greater, showing that the odds are clearly in favor of the horse system. Owing to the new machinery the cost of maintenance has so far been abnormally small and the true earning capacity can therefore not be fully decided until it has been shown what the true cost of maintenance is; they conclude that taking everything into account there has thus far been no demonstration of the superior net earning capacity of the electric as compared with the horse system, but rather the reverse, and that the electric system has not shown such a margin of profit which will justify the expectation of more than moderate and ordinary returns for the money legitimately invested. The editorial, which is intended to show the bad effects of over-capitalization, states that the total capitalization of street railways to-day is more than $1,300,000,000 or more than $95,000 per mile of track and according to the best authorities this represents an actual investment of not over $450,000,000, or "in other words, these securities are based on one third money and two thirds water."

Electric Railways Condemned by Fire Engineers.—According to the "Eng. News," Oct. 17, the single-trolley system was condemned by the Committee of Electrolysis of the Int. Ass'c. of Fire Engineers in a report made at the meeting at Augusta, Ga. Both this and the double-trolley system were also held in disfavor for use in cities and towns, on account of the dangers and annoyances to firemen caused by aerial wires. The committee wished to impress upon the minds of all chiefs of fire departments: 1st, the necessity of determining whether water mains are being harmed by return electric currents; 2d, in case they are, the urgent need of taking immediate steps to prevent such action; 3d, that all possible influence should be used to prevent the granting of franchises for overhead trolley systems; 4th, water systems may fail at the most critical time through the deterioration of the mains by electrolysis; 5th, gas mains may become leaky from the same cause, and fill soil and buildings with gas, endangering both lives and structures.

Electric Traction on the Brooklyn Bridge.—According to the "Elec. Ry. Gaz.," Oct. 12, the trustees are considering the adoption of electric motors to replace the steam locomotive switching system at the terminals; the Wheless system is under consideration; a motor on the truck of the first car will carry the train to the terminus after the cable is dropped and another on the rear car, which is the front car on the return trip, will switch the train to the outgoing tracks until the cable is picked up; if successful, the electric system will eventually supersede the cable.

Electric Lighting of Trolley Cars.—A suggestion is made in the "Elec. Ry. Gaz.," Oct. 12, to have one of the five lights in series, of a voltage nearly equal to the maximum variation on the line and to cut out this lamp automatically when the voltage falls to that amount; this is to be accomplished by an electromagnet around which the lamp current passes, and whose armature, on being attracted, cuts out a portion of its windings together with the lamp.

B. & O. Locomotive.—According to the "Elec. Ry. Gaz.," Oct. 12, this locomotive pulled 44 loaded freight cars and 3 steam locomotives up the heavy grade at a speed of 12 miles an hour, the draw-bar pull at starting being more than 60,000 pounds and continued throughout the trip at more than 40,000 pounds; the total weight of the train was 1,900 tons.

Storage Batteries in Power-Houses.—In a brief article referring to the development of a storage battery company, in the "Elec. Rev.," Oct. 16, it is stated that a battery plant costing $150,000, worked in conjunction with a trolley system, will show a net increase in earnings of $100,000.

How to Throw on Railway Generators.—The proper method for all the three different systems used in practice is described, and illustrated in the "Elec. Ry. Gaz.," Oct. 12; the description cannot be abstracted.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Lighting Statistics for Large German Cities.—Some good statistics are given in the "Zeit. f. Beleucht.," Sept. 30, concerning the central stations in 39 large German cities, up to January, 1894. The large table given is chiefly of local interest; among the matters of general interest may be mentioned the following: 19 of these 39 stations belong to the municipalities and the most of these are operated by the city, while two of them, including that at Hamburg, are leased by the city to a company; as a rule the continuous current is used and almost all of these stations use accumulators; there is only one alternating-current station, namely, at Cologne, and three 3-phase stations; as a rule the 3-wire system is used; there is comparatively little current used for motors, in Berlin there were 362 motors of 1,230 hp, consuming 485,105 kw-hours or 7.6 per cent. of the total output; the total output for lighting in Berlin was 5,897,412 kw-hours; the electric light is used very sparingly for street lighting in the larger cities, Berlin having at that time only 178 and Hamburg 69 arc lights; the electric light is not used much for private dwellings.

Gas Engine Stations.—The third article on this subject (see Digest, Aug. 25), in the Lond. "Elec.," Oct. 4, an illustrated description is given of the producer gas plant at the Morecambe station, which was erected in 1892, and was the first gas engine station for public electric supply in the United Kingdom; it is run with Dowson producer gas and contains two gas generators of 75 hp and one of 150 hp; there are three gas engines of 25 hp each and one of 100. Regarding the cost of production of the electric energy, it is stated that the coal costs about $4.50 per ton or an average of about one cent per kw-hour, which on short runs has been brought down to 0.6; the normal load of lamps wired is 3,000 incandescent lamps; the power for motors is metered at 1.4 cts. per kw-hour and for lighting it is charged at the rate of $6.25 per year per 16-cp lamp.

Fusible Cut-Out for High Tension Circuits.—An apparatus made in France is described and illustrated in "L'Elec.," Oct. 5. For circuits of over 1,000 volts it is very difficult to prevent the formation of an arc between the two ends of a fusible cut-out, the flash formed being sometimes as long as three feet; the apparatus is intended to avoid the production of such arcs and is said to accomplish this very satisfactorily. The leads terminate in two porcelain boxes mounted next to each other; the bottoms of these boxes are connected by a U tube of thick glass which is filled with a heavy oil, through which passes the fusible wire; the oil has the property of preventing the formation of an arc.

Tunbridge Wells.—The greater part of the issue of the Lond. "Elec. Eng.," Oct. 4, is devoted to a well-illustrated description of the central station at this fashionable watering place; it is an alternating current system, the arc-lighting system being supplied from Ferranti rectifiers.

ELECTRO-PHYSICS AND MAGNETISM.

Phase Shifting in Incandescent Lamp Circuits.—Referring to the recent statement by Mr. Cahen (see Digest, Sept. 28, p. 350), Dr. Breslauer in the "Elek. Zeit.," Oct. 3, gives the results of some experiments made to determine its correctness; the statement referred to was that the phase shifting of an alternating current passing through nothing but incandescent lamps, can be explained by the periodic changes in the resistance of the filament. The most extreme case is evidently when the current is increased in steps very slowly, so that the stable conditions are reached in each case; he therefore took a 102-volt lamp and applied a direct current of different voltages from 0 to 102, the results giving the variations between the current and voltage; these results are given in a table in the article. With the aid of the curve representing these results, and the assumption of a voltage following the sine law, the current curve can be constructed and from this the watt curve, the effective values of the current and voltage and the mean consumption of watts; from this he finds that the power factor, that is, the cosine of the angle, is equal to 0.995, or in other words, the product of the effective values of the current and voltage is only one half of a per cent. greater than the true effect. As this is an extreme case it follows that the power factor can be effected by the change of resistance, at most to the extent of an inappreciable fraction of one per cent. If a phase shifting with an incandescent lamp load has really been observed, and if it was not due to the ampere-meter or other instrument in the circuit, it was probably due to a true self-induction which must exist in some lamps in which the filament makes a spiral of several turns and therefore forms a true solenoid.

Tesla Discharge.—The Lond. "Elec.," Oct. 4, notices a paper by Mr. Overbeck in the "Wied. Ann." No. 8, which shows that the Tesla discharge invariably consists of two oscillatory discharges of different frequencies, which latter are not the same as those of the primary and secondary circuits by themselves; in one case where the latter were both 10,000,000 per second those of the two discharge currents were 8,000,000 and 15,000,000 respectively.

Resistance of Bismuth at Low Temperatures.—The Lond. "Elec. Rev.," Oct. 4, begins a reprint of the article by Profs. Dewar and Fleming from the "Phila. Mag." for September which was abstracted in the Digest, Sept. 21.

Magnetic Force Due to any Plane Circuit.—Mr. Everett in the Lond. "Elec.," Oct. 4, referring to Prof. Minchin's and Mr. Colard's recent statements (see Digest, Sept. 28, Oct. 12), states that the magnetic force at any point in the plane of any plane circuit, is equal to the current multiplied by the integral of the differential of the angle divided by the radius, this angle and radius being "the polar co-ordinates of a point on the circuit, referred to the point considered."

Non-magnetic Metal.—"L'Eclairage Elec.," Sept. 28, states that steel containing 12 per cent. of manganese is non-magnetic and adds that this metal could often be used to advantage in the construction of electric apparatus.

ELECTRO-CHEMISTRY AND BATTERIES.

Electrolysis of Milk.—A short account of a paper by Mr. Phillips is given in the Lond. "Elec.," Oct. 4. He describes experiments undertaken to discover whether electrolysis would offer a more expeditious and reliable method of ascertaining the purity of milk, than those in use. On electrolyzing milk between platinum electrodes the anode became coated with a white, spongy-looking mass, which ultimately became disengaged and floated on the surface; it consisted principally of a mixture of caseine and fat and the milk was slightly alkalined after the operation; by continuing the electrolysis all the solids were extracted leaving a transparent solution but no deposit of any kind took place at the negative electrode; an acid was formed at the anode and an alkali on the cathode. The Andreoli method of indirect electrolysis was then tried by dividing the vessel into three compartments with two porous partitions, the milk being in the centre division, while the other compartments contained

a solution of sodium chloride; on passing a current, a deposition was formed in the central compartment on the side toward the anode; when all three compartments contained milk a deposit occurred on the sides of both partitions farthest from the anode and it seemed that no action took place in the milk in the central compartment and no deposit took place on the metallic plates in the milk in either case. Some unsuccessful experiments were made to preserve milk by this electrical withdrawal of a portion of the caseine; Mr. Swinburn, however, stated that milk can be sterilized electrically, in that journal, Vol. 29, p. 391; platinum is the most suitable material, as the lactic acid formed attacks almost all the other metals.

Chlorates and Hypochlorites by Electrolysis.—In commenting on the recent experiments of Mr. Oettel, the Lond. "Elec. Rev.," Oct. 4, states that it is generally supposed that hypochlorite is formed in the electrolysis of potassium chloride when cold and chlorate when warm; Oettle, however, showed that hypochlorite was not the only product at ordinary temperatures and that a small quantity of perchlorate was also formed; it adds that there is no reason for supposing that these experiments were not accurately conducted, nor for presuming that the results did not warrant the conclusions, but the experiments seemed to have been conducted with only a small portion of caustic potash present. In a more recent paper he describes experiments in which the proportion of the alkaline was increased, which modified the reactions in quite an unexpected manner; by the electrolysis in stronger alkaline solutions, chlorate is formed directly without the intermediate production of hypochlorite; "this direct electrolytic process is clearly simple and elegant, the only practical question being the expense of the anodes." He calculates that 88.14 grammes of the chlorate should be obtained per effective electrical hp-hour, or the production of one kg would requre 11.33 hp-hours.

Electrolysis of Alkaline Chlorides.—The Lond. "Elec.," Oct. 4, gives a brief description, by the inventor, of the Castner process, which is at present worked on a large scale. The essential feature is the use of a movable body of mercury at the bottom of the vats which completely separates the products of electrolysis, taking the place of the diaphragm; the cell is divided into three parts and is continuously rocked or tilted causing the mercury at the bottom to flow from side to side (under the lower edges of the two walls separating the three compartments from each other); the two outside compartments contain the chloride solution and the carbon anodes, while the middle contains the iron cathode and the caustic solution; the chlorine escapes through an aperture into a collecting main and the sodium amalgam passes to the centre compartment where the sodium goes into solution.

Electrolytic Cell.—In the "Elektrochem. Zeit." for October, Mr. Hargreaves comments briefly on the Hargreaves-Bird cell. The chief difference between this and others is that the cathode is not immersed in a liquid but is in contact with a diaphragm which forms the wall of the anode compartment; the only liquid in contact with the cathode is that due to capillarity; there is therefore a film of gas on one wall of the cell and this enables air and other gases to be used as auxiliary reagents; if hydrogen is given off it will be largely oxidized in the presence of oxygen while carbonates are readily formed in the presence of carbonic-acid gas; the electrochemical output is 70 per cent. and with pure products 97 per cent., while in the laboratory 92 and 99.90 per cent. were obtained respectively.

Aluminium.—"L'Elec.," Oct. 5, extracts briefly from the "Revue Scientifique" a description of a new process. It has long been known that the sulphide of aluminium is more easily reduced than alumina, and it has been shown that the energy required is less, while at the same time the sulphur can be recovered; the production of the sulphide, however, was difficult; Mr. Gruy suggests overcoming this difficulty by decomposing the double chloride of sodium and aluminium with the aid of fused sulphide of sodium; this forms sulphide of aluminium and chloride of sodium. Mr. Jaennigen converts alumina into the double sulphide of sodium and aluminium by heating alumina and carbonate of soda in a current of the vapors of sulphide of carbon; the reduction of the sulphide is accomplished like that of alumina.

Gold from Sea Water.—Referring to some daily paper paragraphs regarding schemes for the recovery of gold in sea water, the Lond. "Elec.," Oct. 4, describes one method, which consists in using plates of iron as anodes and plates of amalgamated copper or zinc as cathodes, which in some cases may be arranged to hold a certain quantity of mercury; these plates form, in conjunction with the sea water, an electric battery, or may be connected to a dynamo; the gold, it is claimed, will be deposited on the copper cathode or on the mercury, it being supposed to be in combination with iodine; the chief point is to have the greatest possible volume of sea water pass between the plates.

Morisot's Battery.—A translation from the French of a description of this battery, (see Digest, Sept. 14) is given in the Lond. "Elec. Rev." Oct. 4.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Localizing a Fault.—Mr. Cann in the Lond. "Elec. Rev.," Oct. 4, describes a simple method of applying Kennelly's law. The law is that the apparent resistance of a fault is inversely proportional to the square root of the current passing through it; the present formula is somewhat more simple and the results can therefore be more easily worked out. If the current passing through the fault be quadrupled, the apparent resistance of the fault is reduced by one half and therefore the difference between the two resistance values obtained in the cable circuit with testing currents bearing the ratio of 4 to 1, subtracted from the lower resistance obtained with the stronger current, will give the distance of the fault from the testing station; the two testing currents must bear the relation of 4 to 1 and should not exceed 25 milliamperes. A number of illustrations are worked out by means of this and by the Kennelly formula showing a very close agreement; he has used this frequently.

Simple Ampere-Hour Meter.—The Lond. "Elec.," Oct. 4, publishes an illustrated description of the Collinson meter, the object in the design of which was to obtain a cheap yet efficient ampere-hour meter; it is the intention to sell this one for $15. It is based on the measurement of electric quantity in terms of the weight or volume of a liquid permitted to pass through a throttled passage, the amount of constriction depending on the electric current. The current to be measured passes through a solenoid having a movable iron core suspended by a spring; its vertical motion, which depends on the current, operates a valve at the bottom of a tank kept filled to a certain level with a liquid, and allows it to run into graduated vertical tubes, the readings on which give the quantity in kw-hours; meters ranging to 50 amperes are claimed to run six months without attention.

Electrometer.—The Lond. "Elec.," Oct. 4, gives a translation in abstract, with the illustrations, of the description of the improved Hallwachs' electrometer, from the "Wied. Ann." No. 5., an abstract of which was given in the Digest, Aug. 17.

TELEGRAPHY, TELEPHONY AND SIGNALS.

British Telegraph Service.—The Lond. "Elec.," Oct. 4, reprints a portion of the Postmaster General's annual report on a "Historical Outline of the Telegraph Service Since 1870" and discusses it editorially.

Field Telegraphy in Chitral.—The paper mentioned in the Digest last week is reprinted in full in the Lond. "Elec. Rev.," Oct 4.

MISCELLANEOUS.

New Photographs of Lightning.—The Lond. "Elec. Rev.," Oct. 4, translates from "L'Ind. Elec.," the Academy note of May 26, by Mr. Biltschikoff. He describes three typical photographs to which he gives the names of ribbon lightning, tube lightning and waterspout lightning, the latter of which he obtained only once, while the others he has noticed repeatedly. The ribbon lightning is shown in the photograph in the form of a ribbon with many folds, but untwisted; the width as calculated from measurements on the photograph, was 12.5 metres; the ribbon comes out of a cloud, grows faint and fades away; in another case the width was calculated to be 62 metres and in another 21. From a photograph of a flash of tube lightning, he calculates that the diameter was 15 metres and in another 21. Regarding the waterspout lightning he does not venture to express an opinion. He considers it somewhat rash to state that the disruptive discharges of our sources of electricity are in all points similar to real flashes of lightning and he asks whether any of the above forms can be produced artificially. Regarding the ribbon lightning he states that very fine lines of lightning on the same plate, which were taken simultaneously, show decisively that the ribbon was not due to a displacement of the photographic apparatus; he suggests its possible relation to the draperies of the aurora borealis.

Physiology of Death by the Electrical Shock.—The Lond. "Elec. Eng.," Oct. 4, quotes some statements by Mr. McClure. It cannot be contested that strong arterial contraction and engorgement of the large veins and right side of the heart, are present in death from an electric shock; the contraction he believes is due to a physical cause which, however, does not act primarily on the contents of the vessel, but rather upon the badly conducting or insulating nerves and arterial centres; he states that electrical energy does not travel in a wire, but in the insulating sheet around it, and concludes that the blood and fluids correspond to the wires and the transparent tissues to the dielectric, which transmit all the energy; the kinetic electricity in traversing such tissue becomes static and results in a strain; the stress, if strong enough, may result in electrolytic disruption; there is tension along the lines over which electricity is traveling and pressure at right angles to this, and this is the force which would narrow the calibre of the artery; it has a spring-back force, which, however, cannot act after death, leaving the arteries permanently contracted.

Prevention of Collisions at Sea.—The Lond. "Elec. Rev.," Oct. 4, states that an interesting and important experiment is being made in the English Channel to reduce the risk of collisions at sea in fogs, at night. An electric searchlight is fixed in the forepart of the ship and, when a blast of the fog whistle is given, the searchlight is used to flash a powerful, vertical beam of light in the air, by means of which the position of the vessel may be determined, by another approaching it.

Acetylene.—The "Elektrochem. Zeit." for October contains an article of some length by Dr. Luepke in which he gives a general summary of the subject. In conclusion he gives a table containing a number of columns of the latest data for all the various methods of lighting, the last column of which gives the number of candle hours which can be obtained for one mark, which is equal to about 24 cts. The figures in this column are as follows: Wax candle, 33; stearine candle, 77; rape seed oil, 150; illuminating gas with acetylene, 435; electric incandescent, 440; illuminating

slot burner, 625; Argand burner, 695; acetylene with air, in slot burner, 716; petroleum in Cosmos burner, 833; in Prometheus burner, 923; acetylene in Reginal lamp, 970; oil gas in Pintsch burner, 1,660; hydrogen and benzol, 1,666; illuminating gas in regenerative burner, 1,890; petroleum in Million lamp, 2,222; arc light, 2,232; Schuelke petroleum gas lamp, 2,250, Welsbach light with illuminating gas, 2,300; hydrogen in Fahnehjelm burner, 2,380; Duerr petroleum vapor lamp, 3,333 and Welsbach light with hydrogen, 4,350. Attention is called to the fact that the cheapest light according to this scale is not always the most suitable, as there are other factors to be taken into consideration.

Calcium Carbide and Acetylene.—According to "L'Eclairage Elec." Sept. 28, the Neuhausen factory sells calcium carbide in quantities of 2,200 pounds at 10 cts. per kg, (which is equal to about 4.5 cts. per pound). The firm of Eimer & Amend, of New York, sells it in quantities of 55 pounds at 58 cts. per kg (which is equal to about 26 cts. per pound).

Liquid Acetylene.—Liquid acetylene is produced and sold by a company in Mannheim, who sell it in vessels containing 3 to 5 kgs at $3 per kg at the factory; it hopes to be able to reduce the price to 50 cts. per kg (equal to about 23 cts. per pound) if the demand becomes sufficiently great.

British Association.—A number of the electrical papers which have already been noticed in these columns are reprinted in full or in abstract in the Lond. "Elec Rev.," Oct. 4.

Biographical.—A portrait and biographical sketch of Sigmund Schuckert, who died Sept. 17, is published in the "Elek. Zeit.," Oct. 3. Lond. "El'ty.," Oct. 4, publishes good portraits accompanied by brief biographical sketches, of 16 of the leading British authors in the electrical field.

Atmospheric Electricity and Bodily Health.—An article from the Lond. "Lancet" is reprinted in the "Elec. Rev.," Oct. 16. It is thought possible and even probable that the electrical conditions of the atmosphere have an important bearing on health; various maladies are experienced just before a thunder storm, but whether they are attributable to the electrical conditions is difficult to determine. Regarding the source of atmospheric electricity, there are many hypotheses but little knowledge; it is probably connected in some way with the presence of water. The air above being charged, a man standing on the earth may be regarded as a discharging point and the difference between the potential at the head and the feet may be subject to sudden and extensive fluctuations; Lord Kelvin found that in a vertical height of nine feet it may vary from 200 to 400 volts and may even increase to 4,000; the animal body may be seriously influenced by the great fluctuations in a thunder storm; experiments with the Holtz machine showed that when the body was charged with 30,000 volts, the current passing being about one forty thousandth of an ampere, there were well-defined physiological effects, including increased action of the skin, an influence on the blood pressure, an increase in the frequency and depth of respiration and an increase in the excretion of urea and phosphates; owing to electrical conditions in the atmosphere a man lives and moves in an electrostatic bath; in conclusion it is thought not impossible that the electrical conditions of the air may eventually furnish the key to treatment by the electrostatic bath.

New Flush Switches.

The increasing demand for flush switches, adapted to be set in the wall with finished metal covers practically flush with the surface of the wall, has led the Hart & Hegeman Manufacturing Company, of Hartford,

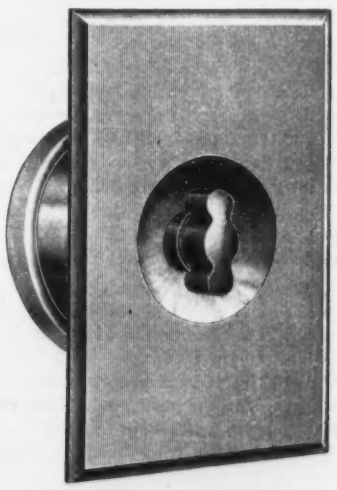


Fig. 1.—Flush Switch.

Conn., manufacturers of the well-known Hart switches, to bring out an improvement in this line of goods. The first flush switches on the market were made by attaching the switch to a rough cast plate for holding the switch to the wall, the whole being covered and concealed by a finished thin sheet metal plate with flanged edges held in position by the switch handle, which set in a recess in the face of this plate, thus avoiding any screw heads on the surface of the finished plate.

These finished plates, being made of thin metal, were very liable to become injured in use, and at the best were not perfectly flat. The new

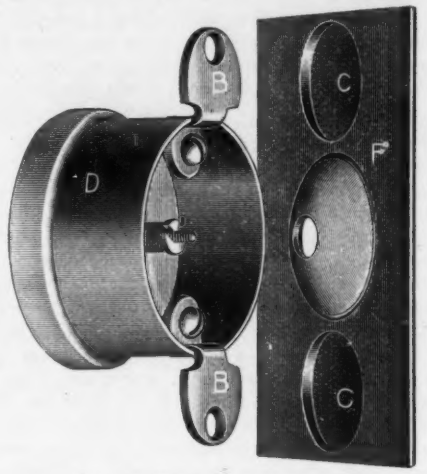


Fig. 2.—Details of Switch.

plate illustrated in Fig. 1, is made of solid plate brass, ⅛ inch thick, with edges milled to a bevel. The switch itself is attached to a brass ring, *D*, Fig. 2, having ears, *B*, for fastening it to the wall. When this ring, with switch attached, is screwed to the wall, the ears project from the face of the wall, and are accommodated by pockets, *C*, in the back of the face-plate, *F*, allowing this plate to set back against the wall. In all flush switches made on the old plan there is always a variation in the distance from the face of the plate to the porcelain base of the switch, and when the handle is screwed on it frequently binds on the plate, making it turn hard and oftentimes breaking the handle, or else it does not screw down far enough to hold the plate in position, and allows it to rattle when the switch is turned. This difficulty is particularly noticeable in gang-plates for a number of switches, and if the handles are not put back on the same switches with which they were shipped from the factory, it frequently gives the construction men much trouble.

Fig. 3.—Handle.

This difficulty is now obviated by the self-adjusting handle shown in Fig. 3. The collar, *A*, of this handle has a vertical movement with reference to the body of the handle of more than $\frac{1}{16}$ inch and is held downward by a flat spring which it encloses and conceals. The spring-pressed collar holds the face-plate firmly against the wall with an easy, elastic pressure. The shape of the handle is easy to the fingers, and the large section of material around the metal interior gives it great strength. The material is stronger than that heretofore used. The range of movement of the collar, *A*, compensates for all variations liable to occur in the distance from the face of the plate to the porcelain base of the switch. This adjustment makes all handles, switches, and face-plates interchangeable, with no danger of the handles binding on the face-plates, either breaking the handles or causing them to turn hard, or of the face-plates being too loose. Single plates for all sizes of Hart switches, and gang-plates for any number of switches, are now furnished, made as described above and with self-adjusting handles. The gang-plates are frequently furnished with bell buttons or automatic gas lighting buttons set in the plate.

A New Incandescent Lamp.

The accompanying engravings represent a new incandescent lamp, manufactured by the Adams-Bagnall Electric Company, of Cleveland, Ohio, the "newness" of which does not consist simply in a newly-figured or an odd-shaped bulb; there are really some material changes embodied in the lamp.

The "A-B" lamp is constructed without the tip on the large end of the bulb which is so familiar in other lamps. As most readers know, this tip is caused by welding a tube to the large end of the bulb and then sealing off close to the bulb when the air has been exhausted from same. In order, therefore, to get rid of this tip it is necessary to seal off at the other end, and to do this the usual glass mount must be abandoned. This, of course, changes the entire interior construction of an incandescent lamp, and owing to this feature the "A-B" lamp presents an appearance peculiar to itself. The side of the bulb is drawn inwardly in the shape of sharp pointed projections, which take the place of the usual glass mount, and the platinum wires are carried through the walls of the bulb at diametrically opposite points, as far apart as it is possible to place them, obviating all trouble from short-circuiting at the leading-in point.

Another feature in the manufacture of this lamp is the application of a small brass ferrule to the neck of the bulb during the process of construction. When the outer wires have been attached to the platinum wires they are laid along the neck of the bulb in small grooves provided for that purpose. Over these wires and the neck of the bulb is then placed the ferrule, which seats on the glass. The plaster or cementing substance is then placed in the open end of the ferrule, filling the grooves and depressions in the glass made for its reception.

LAMP FERRULE.

THE A-B INCANDESCENT LAMP.

After this the bulb is exhausted and sealed off at the neck end. The lamps are placed in stock in this shape. It can be readily understood that with an open-end ferrule the plaster can be better applied during the process of construction and has ample time to dry before the lamps are shipped to market. This avoids all trouble arising from green lamps or lamps which will loosen at the base. The form of an ordinary lamp base is not such as to admit of its being attached properly by plaster to the neck of a glass bulb, and the additional brass ferrule seems to perform an important function in correcting this difficulty in the manufacture of incandescent lamps. The fastening of the lamp base to the ferrule is accomplished by mechanical means, and without loss of time by waiting for plaster or cement to dry. Patents have been awarded this month to the Adams-Bagnall Company covering this lamp and its method of construction.

A New Storage Battery.

A new type of accumulator plate has recently been perfected by Mr. J. Hart Robertson, and is now being exploited by the Standard Storage Battery Company, of 50 Exchange Place, New York. The plate is made up of pulverized pumice stone and lead; that is to say, the pumice stone is mixed with lead while the latter is in a semi-molten condition, the whole making a pasty sort of compound, principally lead, of course. After being thoroughly mixed the mass is compressed in a mold of the proper shape and left to cool. The object in mixing in the pumice stone is to obtain a porous construction and give a very large active surface as well as to provide cells for the active material. The inventor states that while the particles of pumice stone may be eaten out if desired, this is not at all necessary, owing to the highly porous nature of the stone. This characteristic is forcibly demonstrated by placing one of these plates in water and noting the amount of fluid absorbed within a comparatively short time. It is said that a plate 7 x 9 x 1 inches absorbed a fraction over 11 ounces of water. Mr. Robertson claims that from many experiments so far made he is positive that a cell of a given capacity will weigh one third less with his plates than with any other type.

The accompanying engravings show a fragment of mixed lead and pumice stone, such as is used in the construction of this battery, and the discharge curves of a 15-pound cell which was formed in 140 hours with a current of one ampere per pound of lead. This cell was rated at 50 ampere-hours, but the upper curve shows a considerably greater capacity.

FIG. 2.—SECTION OF BATTERY PLATE.

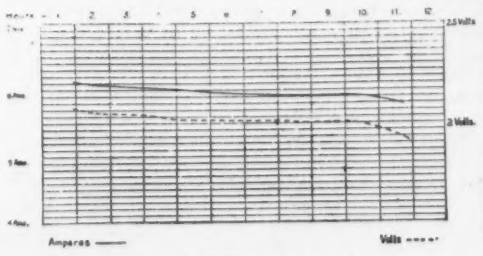


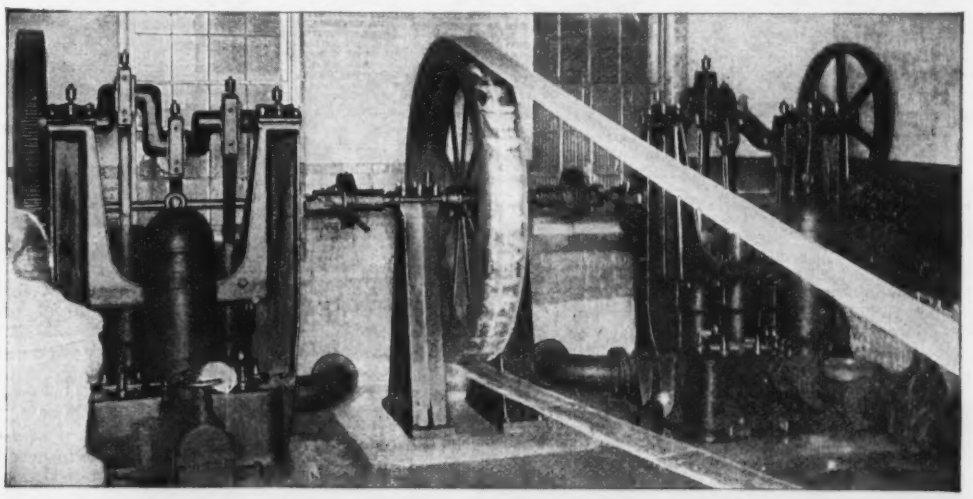
FIG. 1.—DISCHARGE CURVE.

Electrical Pumping Plant at Oswego Falls, N. Y.

The advantages of electrical pumping are very well illustrated in the accompanying views made directly from photographs of the pumping plant of the Fulton Woolen Company, of Oswego Falls, N. Y. The pumping apparatus consists of two 8-inch diameter by 12-inch stroke cylinder Goulds triplex power pumps, made by the Goulds Manufacturing Company, of Seneca Falls, N. Y.

The pumps, at 40 revolutions per minute, have a capacity of 624 gallons. They are operated by a Westinghouse motor, running at 1,300 revolutions per minute, and belted to a countershaft to which the pump shafts are connected by means of two friction clutches, rendering it possible to operate the pumps singly or in pairs, and to start or stop them without the necessity of stopping the motor. The current for operating the motor is supplied from the dynamo which is used to light the mill.

The pump-house, which is a substantial brick building 25 by 35 feet, is situated half a mile from the mill on the shore of Lake Neahtawanta, from which the water is taken. This plant is an apt illustration of the possibility of making use of existing water supply by means of electrical pumping apparatus. This is not only true of plants for mill and factory supply, but equally true in plants of large capacity for domestic and fire purposes where large quantities of water are pumped. Until within a few years the field of pumping has been practically given up to steam-pumping machinery. To-day, however, electrical pumping apparatus has attained a success the permanency of which seems assured.



ELECTRICAL PUMPING STATION.

NEWS OF THE WEEK

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, Oct. 19, 1895.

AMERICAN BELL showed some weakness this week, declining from 199¾ on Monday to 197½ on Thursday, where it stuck until the close.

ELECTRIC STORAGE, both common and preferred, is holding its own. The stocks have advanced steadily for several weeks past. The amount of stock offered on the market was small, and quickly absorbed.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked.
Chicago Edison Company	100	120	125
Edison Electric Ill., New York	100	98	100
" " " Brooklyn	100	110	115
" " " Boston	100	..	152
" " " Philadelphia	100	..	115
Edison Ore Milling	100	13	15
Electric Storage Co., Philadelphia	100	74¼	74½
Electric Storage, pref	100	75¼	75¾
General Electric	100	36¾	37⅛
General Electric, pref	100	67	68
Westinghouse Consolidated, com	50	35½	36
" " pref	50	55	55½

BONDS.

Edison Electric Ill., New York	105	105½	105½
Edison Electric Light of Europe	100	75	85
General Electric Co., deb. 5s	100	..	90¼

TELEGRAPH AND TELEPHONE.

American Bell Telephone	100	197	197½
American District Telegraph	100	35	40
American Telegraph & Cable	100	94½	98
Central & South American Telegraph	100	117	120
Commercial Cables	100	150	..
†Erie Telephone	100	68¼	68¾
Gold & Stock Telegraph	100	105	..
New England Telephone	100	89	89½
Postal Telegraph-Cable	100	63½	..
Western Union Telegraph	100	91⅝	91⅞

ELECTRIC TRACTION STOCKS.

Baltimore Traction	25	18⅜	18⅝
Binghamton RR. com	100	100	..
Brooklyn Traction	100	14¾	16
" " pref	100	61	63
Buffalo St. Ry	100	84	86
Cleveland City Ry	100	69	70
Cleveland Electric Ry	100	59	60
Columbus St. Ry	100	55	57
Consolidated Traction of N. J	..	25	..
Electric Traction, Philadelphia	50	66	66½
Hestonville	100	54	55
Long Island Traction, all pd	100	19½	20
Louisville St. Ry. com	100	37	39
" " " pref	100	87	88
New Orleans Traction	100	20	22
" " pref	100	70	73
North Shore Traction	100	36	37
" " pref	100	88	89
People's Traction $30 pd	25	58⅞	59¼
Philadelphia Traction	50	76	77
Rochester St. Ry	..	35	38
Union Ry. (Huckleberry)	100	112	115
Union Traction, rcts $5 pd	..	21	21¼
West End, Boston	100	70½	70¾
" " pref	100	89	90
Worcester Traction	100	17	18
" " pref	100	88	91

BONDS.

Buffalo St. Ry. 1st con. 5s	100	108	110
*Binghamton Railway Co. 5s	100	99	100
Cleveland Elec. Ry. 1st mtge 5s	100	103¼	104½
*Columbus St. Ry. 1st 5s	100	100	102
Rochester St. Ry. 1st 5s	100	102½	104
*Union Ry. 1st mtge 6s	100	105	108
*Westchester Electric 1st mtge 5s	100	98	101

* With accrued interest.
† Ex-Div.

THE TRACTIONS.—The traction market has been practically monopolized by the city street railway issues, which have been more active than for some time past. The uncertainty regarding the leasing of the Brooklyn Traction Company has been reflected in the price of its securities. It is reported that a suggestion was made for the Nassau road to guarantee a four per cent. dividend on the Brooklyn Traction preferred stock, which is now a six per cent. accumulative (although nothing has been paid since July, 1893,) and a dividend of 1½ per cent. on the common together with the fixed charges on the underlying bonds. Another plan reported to have been suggested was the wiping out of the common stock entirely and the guaranteeing of a 6 per cent. dividend on the preferred. None of the various propositions, it is said, has as yet been accepted. Should the two roads unite, the Brooklyn Traction Company would gain terminals at Manhattan Beach, Canarsie, and Fort Hamilton, while the Nassau road would acquire the outlet to the ferries, which it does not now possess. Later rumors current on the Street connect the Nassau road and the Brooklyn Elevated as joint purchasers of the east end of Coney Island. These various reports have affected the price of Brooklyn Traction securities considerably. After selling in the neighborhood of 65, the preferred declined to 60 bid, while the common remains practically unchanged. The stockholders of the company at a recent meeting elected the following board of directors: J. A. Snyders, J. P. Ilsley, C. Ford Stevens, C. A. Pierson, Jr., P. F. Vaughan, Albert Strauss and E. D. Phillips.—Brooklyn City Railway stock has been somewhat stronger, and a renewed demand appears to exist for the first mortgage bonds of the Brooklyn Queens County & Suburban road. In order to lessen if possible the number of accidents on the road, the Brooklyn City directors have offered $10,000 to be divided among the conductors and motormen whose cars shall have been free from casualties up to May 1, 1896, and who have most faithfully observed the company's rules.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, Oct. 21, 1895.

MR. FREDERICK L. EBERHARDT, of Goulds & Eberhardt, the well-known machine tool builders of Newark, N. J., was married, on Oct. 16, at Alton, Ill., to Miss Martha Low Boals. The happy couple will reside at Newark.

THE BRYAN-MARSH COMPANY reports quite a demand for its 2½-watt lamps. A recent order was for 5,000 lamps, and the company is daily in receipt of moderate orders for trial, which are usually followed up by the steady use of the high economy lamps.

A LARGE STORAGE BATTERY PLANT.—The Electric Storage Battery Company has closed a contract for a complete electric lighting plant for the New York residence of Mr. Charles T. Yerkes. The generating plant consists of an Otto gas engine of 35 actual horse-power belted to a 30-kw Siemens & Halske shunt-wound dynamo, and four pole booster of 7½-kw. The storage battery consists of 60 cells of type 25-G in lead-lined tanks. These cells have a capacity of 2,500 ampere-hours at a ten-hour discharge rate, the maximum discharge rate being 500 amperes for four hours. Mr. Yerkes's residence, at Sixty-eighth Street and Fifth Avenue, New York City, is wired for about 1,200 16-cp lamps, and has besides an electric passenger elevator and several electric motors for ventilating, pumping and other purposes. This will be the largest storage battery plant for private house use in this country.

TROLLEY LINES TO THE BRIDGE.—The committee of the Brooklyn Bridge trustees which for several months has been considering plans for the improvement of the trolley car facilities at the new Brooklyn terminal, and for the relief of the congested traffic on Fulton Street, has adopted in part the plan submitted by the Brooklyn Heights Company, which has sole control of the tracks on Fulton Street between Washington and Sands Streets. The scheme provides for a loop and three extra tracks on the Liberty Street side of the bridge, between High and Sands Streets. All down-town cars will turn from Fulton Street to a loop running parallel with the north side of High Street; thence alongside the bridge station and over Sands Street to the present tracks running through to the ferry. Another loop will be formed by a track running almost diagonally from the main Fulton Street track at a point below the bridge station to the rear end of the new stand. There will be but slight encroachment on the plaza, the company only receiving 40 feet instead of the 60 feet it asked for, and its request for the use of Liberty Street is refused. The company is to build its own terminal and pay the city $2,000 a year for the privilege it receives. It is estimated that the city expended at least $50,000 in providing the terminals for the elevated companies. All that the Brooklyn Elevated Company pays the city for the privelege granted to it is $2,500 a year while the Kings County Company only pays $400. The Heights Company will begin laying new tracks for the plaza stands as soon as the bridge trustees have formally accepted the report of the committee.

NEW ENGLAND NOTES.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, MASS., Oct. 18, 1895.

MR. E. E. CARY has resigned his position as superintendent of the Beacon Lamp Company.

THE QUESTION OF MUNICIPAL LIGHTING is again being agitated here, and a special committee of the City Council has just presented a report advocating in substance that it would be expedient for the city to establish and maintain a plant, which from past experience will probably amount to nothing more than a revival of the question, with no results, at the forthcoming session of the State Legislature, and more work for President Gilbert and Councillor Burdett, of the Boston Electric Light Company, in demonstrating the value and cheapness of its service.

THE STRIKE of the iron, steel and brass moulders at the Lynn works of the General Electric Company has been declared, and already the effect has commenced to manifest itself by a temporary suspension of quite a number of employees in other departments of the works. So far as known no moulders have been engaged to take the place of the strikers, but the company promises to make every proper attempt to keep the factory supplied with castings. The strike has revived the talk of the removal of the works from Lynn, and Superintendent Fish is quoted as saying that it will unquestionably intensify that desire, over which, very naturally, the merchants of Lynn and West Lynn are no little concerned.

THE NATIONAL TELEPHONE MANUFACTURING COMPANY, of Boston, filed with the United States Circuit Court of Boston, last Tuesday its answer to the suit of the American Bell Company for infringement of the Berliner patent. The answer denies that Berliner was the first and original inventor of the microphone, and that the exclusive right to use the invention of the microphone was lawfully granted to the Bell Company, and claiming that the Berliner patent is invalid by reason of the delay in granting it, for which delay the defendant can see no reason why it and the public should suffer. In an interview the National Company reiterated the determination to make a strong defense and fight with even greater warmth and vigor.

THE LOMBARD WATER-WHEEL GOVERNOR COMPANY is constantly in receipt of most valuable testimonials even more than confirmatory of the claims it has advanced for the recognition it has so liberally received and is still receiving. It has just issued a leaflet covering recent letters of strong endorsement from the Massachusetts Cotton Mills, of Lowell, Mass., and the Baltic (Conn.) Power Company, both of which furnish diagrams showing the speed regulation of the governor, the diagram of the former showing also a comparison of speed regulation with another governor supplanted by the Lombard and showing for it a steadiness of regulation truly remarkable. Letters are also presented from the Montague Street Railway Company, of Greenfield, Mass., and Hollingsworth & Whitney Company, of Waterville, Me. These letters represent only a small percentage of those received, and are used because of the prominence of the corporations, and the explicit testimony as to the value of the Lombard governor which is guaranteed by the company to hold the speed of any water-wheel within 3 per cent. under any variation of load, and has in some instances governed within 1 per cent.

THE THOMPSON-BROWN ELECTRIC COMPANY celebrated, in its new quarters, 125 Pearl Street, Thursday evening, Oct. 17, the first anniversary of its business existence, and furnished a rare treat to its friends and patrons, who were present in large numbers. The new store presented a fine appearance, the word "Welcome," profusely illuminated by incandescent lamps, greeting all upon entering. A nice lunch was provided and served during the evening, and a colored musical quartette rendered choice and lively "old-time" melodies. Later in the evening, through the courtesy of the management of Keith's Theatre, a large patron of the company, several prominent artists performing at this theatre added greatly to the enjoyment of the occasion through the presentation of popular and entertaining specialties, coupled with all of which, at brief intervals all through the evening, the genial and popular Thomas H. Bibber, through his inimitable and effervescent humor, kept everybody in roars of laughter, and which, in connection with a "humorous ditty" upon the Thompson-Brown Company, its management and attaches, sang by Mr. Chas. Roberts, of the company, contributed to a very pleasant evening's entertainment, over which President Geo. Thompson and Treasurer Maybin W. Brown may feel justly proud, and they also have reason to feel greatly gratified at the many evidences of esteem and good will manifested for their electrical staff, Messrs. Herbert P. Brown, Wilfred Thompson, J. S. Keenan, H. N. West and Charles Roberts, all of whom contributed their share to the pleasure of the evening.

WESTERN NOTES.

Branch Office of THE ELECTRICAL WORLD,
936 Monadnock Building,
CHICAGO, Ill., Oct. 18, 1895.

WILLIAM HOOD, so well known to the electric fraternity of the West, has accepted a position with the Chicago branch of the Electric Storage Battery Company of Philadelphia.

MR. W. R. PINCKARD has severed his connection with the C. E Woodruff Company to take a position in the electrical department of the Bradford Belting Company, 236 Randolph Street.

MESSRS. H. H. BROOKS AND A. D. CHANDLER have established a branch office at 1114 Marquette Building for the American Circular Loom Company, from which the entire Western business is handled under the supervision of Mr. Chandler.

MR. A. L. KUEHMSTED. of Minneapolis, has succeeded Mr. Chas. E. Gregory in the management of the C. E. Gregory Company. Mr. Gregory has been failing in health for some time, brought about by too close attention to business, that it has become absolutely necessary for him to take a much-needed rest.

THE METROPOLITAN ELECTRIC COMPANY is increasing the capacity of its offices and storerooms and has added another specialty to their assortment, by accepting the general Western agency for J. Grant High & Co.'s switches, switchboards and electrical specialties. Mr. William H. McKinlock, president of the company, has just left for Minneapolis on a business trip.

THE ELLIOTT-LINCOLN ELECTRIC COMPANY has been succeeded by the E. & C. Electric Company, with the following officers: President and treasurer, J. E. Crawford; vice-president, S. K. Elliott; secretary, W. A. Crawford; electrical engineer, C. E. F. Ahlm, formerly with the Walker Manufacturing Company; general manager, G. B. Elliott, also from the Walker Manufacturing Company.

THE COLUMBIA LAMP COMPANY'S Chicago manager, Mr. J. M. Hill, has just returned from Washington, D. C. He says the government has been making experimental tests of lamps, and have come to the conclusion that it is false economy to buy a cheap grade of lamp. Mr. Hill says cheap lamps have had a big swing in the western territory, but the change has come, and very shortly they will be numbered with the "have-beens."

MR. G. F. PACKARD, lately of the General Electric Company's designing engineering force, has, with the beginning of the present month, entered the employ of the Fort Wayne Electric Corporation at Fort Wayne, Ind., where he is at present engaged in designing a new line of direct-driven power and lighting generators, soon to be manufactured by the Fort Wayne Corporation. For nearly eight years Mr. Packard has been connected with the Thomson-Houston and General Electric Companies at Lynn and Schenectady.

THE GATES ELECTRIC MANUFACTURING COMPANY is putting on the market a line of multipolar generators and motors, belted and direct-connected. They have recently sold nine machines, ranging from 20 to 100-kw in capacity, and have received compliments from electrical engineers on the fine finish, design and construction of their machines. J. Holt Gates, known as "Gates of Chicago," is president of this company, and Adolph Lissau, formerly chief electrician of the Siemens & Halske Company, is superintendent. Their long experience in the manufacture and sale of electrical apparatus is an assurance as to the character of the apparatus.

CANADIAN NOTES.

OTTAWA, Oct. 19, 1895.

EAGANVILLE, ONT.—An electric light plant is to be installed.

KINGSTON, ONT.—The Kingston Electric Railway Company has given a contract to the Canadian General Electric Company, of Toronto, for six open street cars

MONTREAL.—The percentage of earnings received by the city from the Electric Street Railway Company for the six months ending Aug. 31 made a total of $21,199.

OTTAWA, ONT.—The Ottawa Electric Street Car Company have erected a new car shed, which gives the company an acre of shed area, capable of housing 240 cars.

TORONTO.—Notice is given that within six months, from Oct. 3, application will be made by the Toronto Electric Light Company for power to increase capital stock from $500,000 to $700,000.

KINGSTON, ONT.—The Bell Telephone Company have completed that section of their line between this city and Cornwall. This is a link in the company's long distance service between Montreal and Toronto.

TORONTO.—The Toronto Suburban Electric Railway Company and the Weston Village Council have come to an agreement for the extension of the railway through the village along Weston road. Work will commence at once.

MONTREAL.—The Montreal Park & Island Railway will extend their line to St. Laurent. The proposed extension will be seven miles in length. Engineers are now at work on the survey, and it is expected work will start before the Winter sets in.

QUEBEC.—A new electric light system has been placed in the legislative Assembly Hall, Parliament Buildings. The incandescent lights have been placed in a square in the ceiling. There are 200 16-cp incandescent lamps, making a total of 3,200 candle lights.

HAMILTON, ONT.—During the quarter which closed September 26 the receipts of the Street Railway Company, of Hamilton, Ont., exceeded all previous records. The company's check to the city was for $3,976.16, made up of $2,483.32 percentage and $1,517.84 mileage.

THE MERCHANTS' TELEPHONE COMPANY held its annual meeting this week. The report showed a list of 700 subscribers. Eleven hundred dollars of capital had been forfeited by shareholders not paying up. F. Moisan was re-elected president, Joel Ledue, vice-president, and L. E. Beauchamp, treasurer.

SCHOMBERG, ONT.—A firm of Scotch capitalists have taken the matter in hand and are making preliminary arrangements for constructing an electric railway from Schomberg to connect with the Grand Trunk Railway, either at King, Aurora or New Market. The Grand Trunk Railway will assist in building the line.

LONDON, ONT.—All the trolley cars in this city were called in this week and the old horse cars substituted. The City Council has passed a clause, forbidding the operating of the cars until the engineer's permission had been received and this the engineer was prohibited from doing until the whole electric car system is completed.

MONTREAL.—F. R. Alley has sued the Montreal Street Railway Company for half a million dollars' damages. He alleges that the company promised to run their cars as far as his property at Cote St. Louis, which they neglected to do, in consequence of which he has suffered a depreciation in the value of his property to the extent of the amount named.

BROCKVILLE, ONT.—The new contract entered into by the corporation with the Electric Lighting & Power Company provides that the electric arc lights are to be of at least 2,000 cp, the corporation to pay the company for each incandescent street light lamp $22 per annum, and for each arc light $105 per

annum. The cost under the old arrangement was $4,670, while under the new contract it will be $5,350.

BELLEVILLE, ONT.—Application has been made to the Ontario legislature for a charter giving power to construct and operate electric railway in Belleville City and in the townships of Sidney, Thurlow, Tyendinega, Rowdon, Hungerford and Huntingdon, to be known as the Belleville Traction Company. The capital stock is $100,000. The first directors are S. A. Lazier, S. S. Lazier, T. C. Lazier and H. Pringle, all of Belleville.

ST. CATHARINES, ONT.—The Lincoln Railway, Traction & Light Company, with a capital of $90,000, is applying to the Ontario legislature for power to construct street railways in the townships of Louth, Grantham and Clinton. the city of St. Catharines, the village of Beamsville, and the adjoining townships in Lincoln. R. H. Hill, J. S. Camptule, L. S. Oille, H. A. King and Geo. Palmer, of St. Catharines, are the first directors.

TORONTO.—Since the Canadian Pacific Railway obtained its eastern entrance to the city by way of the Don passengers for the North Toronto and Toronto Junction stations are transferred at Leeside Junction to a small train that runs over the old tracks to Toronto Junction. This part of the line is seven miles long, and it is now stated on reliable authority that the Canadian Pacific intends converting it into an electric line either by trolley or storage battery.

PORT HOPE, ONT.—Application is being made to the Ontario legislature by the Port Hope, Cobourg & Northeastern Electric Railway & Power Company for power to construct an electric railway from the village of Marmora or from Central Ontario Junction in a southeasterly direction through the counties of Hastings and Northumberland to the town of Port Hope, Durham County. Messrs. Howland, Arwoldi and Bristol, of Toronto, are the solicitors for the company.

ST. THOMAS.—The city has accepted the tender of the Street Railway Company for 90 2,000-cp electric street lights, lit 305 nights per year, at 25½ cents per light. This tender is conditional upon the company receiving a franchise to supply power to the street railway, and a deputation of the Council has been visiting Toronto, London and other cities procuring information in regard to street railways. The agreement is to be signed within two months, and it is expected that next Summer St. Thomas will have an electric street railway.

MONTREAL.—The eleventh annual report of the Royal Electric Company, just issued, shows that the net gain on the 15 months' operations were $106,209.14, out of which five quarterly dividends of 2 per cent. each, amounting to $99,900.12, have been declared, the remainder going to the balance of $308,758.98. The gross earnings of the Montreal Street Railway for the year ending Sept, 30, 1895, are $1,096,724.80, as against $882,172.42 for the previous year, being a gain of $214,552.38. The lights on the direct-current arc system have been increased from 1,617 to 1,666; the lights on alternating-current incandescent system from 40,013 to 53,977, and the motors from 347 to 688 horse-power. The Real Estate Association has drawn the attention of the Montreal Street Railway Company to the fact that when the latter obtained the privilege of running its cars upon the streets of Montreal it was stipulated that within one year after operations were begun the company would have all its cars built in this city. It is claimed that this agreement has been ignored, and the City Council is asked to insist that the company be compelled to keep to its agreement.

OTTAWA, ONT.—There is a prospect of a big fight in parliament this season between steam and electricity. Application is being made for an act incorporating the Canadian Electric Railway & Power Company with power under their charter to build and operate an electric railway from Montreal to Windsor, Ontario, via Brockville, Kingston, Belleisle, Toronto and London, with power to build a branch lines from Toronto to Niagara Falls and for a radius not exceeding 25 miles from any point or points on the main line.—In the hands of Ahearn & Soper the electric street car service of this city has been made the first in the Dominion and to the enterprise of this active young firm, the capital of the Dominion is much indebted. There is not an enterprise talked of that shows any reasonable prospects of success that they are not foremost in taking hold of and in setting an example to the old fogies about town who have lots of the needful, but who, like "Old King Cole," prefer setting down "counting out their money" than risk a dollar in any enterprise that will not yield them cent per cent.—The latest move on the part of the Ottawa Electric Street Railway Company is in connecting the village of Hurtonburg with the city. This has necessitated the construction of a five-span iron girder bridge across the Canadian Pacific Railway tracks. The width of the bridge is 24 feet with a four-foot sidewalk. The total length, with approaches, is 2,000 feet.

TORONTO.—Mr. E. A. C. Pew says that the Hamilton & Lake Erie Power Company will be prepared to supply electric energy for heat, power and light by July next. The plan is to tap the Welland River at Wellandport, and carry the water through a canal to the Jordan River. The power-house will be built at Jordan, where there is a fall of 105 feet. Mr. Pew is the projector of the Toronto, Hamilton & Niagara Falls Electric Railway. He expects to have the road between Hamilton and Toronto in operation next Summer. He is also interested in the proposed electric railway from Port Perry to Kincardine.—On the recommendation of the city commissioner the clock in the tower of St. James Cathedral is to be lighted by electricity at a cost of $150 per year.—Electricity is receiving considerable prominence in the school curriculums this year.—Mr. James Patterson, a practical electrician, identified with a local company, opened the classes in the Y. M. C. A. course this week.—S. H. Hoggson, of Chicago, has been in Toronto for the past week endeavoring to interest capitalists in his electric time stamp.—The Toronto Suburban Railway is to be extended through the village of Weston.—Mr. W. T. Jennings, C. E., formerly city engineer for Toronto, is in Edmonton, examining into the advisability of building an electric street railway between that town and the station.—Mr. Earnest Blackwood has been appointed by the Ontario government a fellow in electrical engineering at the School of Practical Science.—The Toronto city treasurer received, within the past week, two checks from the Toronto Railway Company. One was for $15,000, that amount representing one quarter's mileage charges. The other was for $8,522.67, being the city's percentage of receipts for September. The reports show that the company paid the city 8 per cent. on gross earnings of $106,533, an increase of $2,381 over the corresponding month last year. The receipts of the company for September are $16,244 in excess of the receipts for August, in which there were 27 working days as against 25 in September. September was the month of the Toronto Industrial Exhibition. President McKenzie is desirous of attaching letter boxes to trolley cars where people may deposit their mail. He thinks the company could make these collections much more cheaply than the present service and that it would have the advantages of quickness and dispatch. The Post Office Department at Ottawa do not look upon the proposition with favor, as they say the system has not been a success in England.

English Notes.

[FROM OUR OWN CORRESPONDENT.]

LONDON, Oct. 9, 1895.

VISUAL FOG SIGNALS AT SEA.—One of the largest of our Channel steamers has just been fitted, experimentally, with fog-signalling apparatus, consisting of a searchlight arranged to throw a vertical parallel beam from forward of the foremost funnel of the vessel.

TRANSFORMERS IN HOUSES.—A fire broke out at the end of last week at a house in South Kensington, which, it is stated, arose from a transformer contained in the basement having caught fire. Fortunately the flames were speedily extinguished, but not before the transformer itself was completely burned up.

HIGH-SPEED ENCLOSED ENGINES.—It is evident that the boom in high-speed enclosed engines is not at an end in this country. Just recently Messrs. Willans & Robinson, Ltd., have announced a well-earned dividend of 7 per cent., and almost contemporaneously with this announcement comes one from the Brush Company to the effect that they are about to put on the market a new high-speed enclosed engine devised by Mr. Raworth. It will be interesting to see whether by this time next year the Raworth engine will have had any appreciable effect on the profits which have been earned by the prosperous Thames Ditton firm, which, I may remark, is about to remove its works to Rugby, in order to obtain more room and cheaper labor and fuel.

HORSELESS CARRIAGES.—On Tuesday next, the 15th, Sir David Salomons, who, in addition to being chairman of the City of London Electric Lighting Company, and next president of the Institution of Electrical Engineers, also enjoys the honor of being Mayor of Tunbridge Wells, proposes to hold in that sleepy old town, an exhibition of horseless carriages, he himself leading the procession round the ring. The idea of this is to stimulate the agricultural mind of the district and to bring home to it the possible utility of mechanically propelled carriages for agricultural purposes. It must be admitted, however, that a more unfavorable district than that surrounding Tunbridge Wells can hardly be imagined. It is extremely hilly, and the roads are by no means first-class. I do not know whether Sir David Salomons expects great things from accumulator traction for this purpose, but the majority of those who have worked on the subject in this country, and they are many, have reluctantly, but definitely, come to the conclusion that electricity at the present moment does not, for this purpose, stand a chance against many other methods of mechanical propulsion.

ELECTRIC TRACTION.—That portion of the Bristol tramway which runs from Bristol to the suburb of Kingswood, has recently been converted from horse traction to electric traction on the trolley system. The contractors for the electrical equipment are the British Thomson-Houston Company, Limited. On Wednesday last the officials of the Board of Trade made a careful inspection of the line, generating station and cars, and at the close expressed themselves well pleased with all they had seen, and the Board of Trade certificate is expected in a few days. The formal opening of the line to the public is fixed for Monday next, and is to be celebrated in right regal fashion. Besides the usual banquet, and the inspection of the system by a number of electrical leaders, there are to be free trips for shareholders and a substantial dinner and free trips afterward for no less than 1,200 aged and deserving poor who live along the route. The Corporation of Blackburn has recently made an offer to the local tramway company which seems a very reasonable one. It offers to lay down at its electrical generating station sufficient additional plant to supply current to the tramway system of the town, if the company will consent to abolish the obnoxious steam car and to take current from the municipal station at a reasonable price.

General News.

New Incorporations.

THE PENNSYLVANIA HEAT, LIGHT & POWER COMPANY, the capital stock of which is $10,000,000, has been granted permission to construct an electrical plant in Philadelphia, and proposes to begin work at once.

THE LEXINGTON ELECTRIC COMPANY, Kansas City, Mo., capital stock $80,000, has been formed for the purpose of doing a general electric manufacturing business, by E. R. Kimball, C. A. Burton and E. G. Taylor, Kansas City, Mo.

THE BLOCK PLANT ELECTRIC LIGHT COMPANY, Boston, Mass. capital stock, $95,000, has been formed for the purpose of installing, operating and maintaining electric light plants. The promoters are Thomas C. Fitzgerald, Henry Krey and David S. Boyder.

THE VICTOR ELECTRIC COMPANY, Chicago, Ill., has been incorporated to manufacture and deal in electrical and mechanical machinery and devices, and to do electrical work of all kinds. Those interested are C. F. Samms, J. B, Wantz and E. P. Vickers. Capital stock, $2,400.

THE EASTPORT LIGHTING COMPANY, Eastport, Me., capital stock $50,000, has been formed by William A. Carey, Malden, Mass., Walter Campbell and Henry H. Wardsworth, Eastport, Me., to make and distribute gas and electricity for light, heat, power and mechanical purposes.

THE BIG FOUR ELECTRIC COMPANY, Chicago, Ill., capital stock $200,000, has been formed to manufacture, buy, sell, lease and deal in electrical apparatus, devices and machinery, and to furnish light, heat and power. The promoters are Henry D. Ames, William H. Brown and Louis K. Gillson.

THE RAPID TRANSIT COMPANY, Xenia, O., capital stock $300,000, has been formed for the purpose of building and operating a street railway to be operated by electricity or other motive power and for manufacturing electric light, heat and power. The promoters are John Little, S. M. Allison, Marcus Shoup, J. W. Neff and W. R. Baker.

THE SAC CITY ELECTRIC COMPANY, Sac City, Ia., has been organized to erect and maintain an electric plant to furnish light, heat and power. Those interested are L. C. Early, Asa Platt, D. E. Hallett, E. W. Bailey, J. E. Robbins, W. Cheney, J. Y. Campfield, D. J. Dixon, C. W. Marey, George A. Martin, George A. Miller, J. W. Wilson and Philip Schaller. Capital stock, $15,000.

THE FIVE MILE BEACH ELECTRIC LIGHT, HEAT & POWER COMPANY, Wildwood, N. J., have been incorporated for the purpose of constructing, maintaining and operatingworks for the supply and distribution of electricity. The promoters are Frank E. Smith, Charles A. J. Johnson, John W. Rogers, John L. Burke, Holly Beach, N. J. and J. B. F. Bailey, Philadelphia, Pa. Capital stock, $50,000.

THE PACIFIC TRANSMISSION COMPANY, San Francisco, Cal., has been organized for the purpose of generating electricity for light, heat and power; dealing in electrical machinery and tools and constructing telephone and telegraph lines. Those interested are S. E. Kearney, San Francisco; A. S. Babcock, N. H. Henry, Oakland; W. A. Richardson, O. K. McMurray, San Francisco. Capital stock, $3,000,000.

THE LAFAYETTE ENGINEERING & ELECTRIC WORKS, Lafayette, Ind., has been incorporated to manufacture and sell electrical and steam machinery, and engage in the manufacture and sale of articles of all kinds manufactured from wood and metals. The incorporators are: Charles B. Robertson, Henry T. Meigs, John C. Flathers, Edgar V. Burt and Samuel Moore, Lafayette, Ind. Capital stock, $60,000.

TELEGRAPH AND TELEPHONE.

TUSCOLA, ILL.—Tuscola is to have a telephone exchange.

STORM LAKE, IA.—Storm Lake is to have a new telephone company.

RENSSELAER, IND.—The Rensselaer telephone line will be extended at once from Remington to Lafayette.

MARYSVILLE, CAL.—G. L. Jones is contemplating the erection of a telephone line from Kent to Meridian, and thence to Marysville.

CANANDAIGUA, N. Y.—The Postal Telegraph & Cable Company has asked permission to erect poles and string wires through the village.

RED BUD, ILL.—The City Council granted permission at last meeting to the Home Telephone Company to come into the city with its lines.

IONIA, MICH.—At a recent session of the Common Council, Chase Brothers, of Grand Rapids, were granted a franchise for a telephone exchange.

KIETHSBURG, ILL.—The officers of the Mercer County Telephone Company have decided to extend their line from Reynolds to Rock Island.

PARKERSBURG, W. VA.—The Central D. & P. Company announces its intention to build at once telephone lines from Wheeling to Parkersburg.

MERCUR, UTAH.—Just as soon as the preliminaries are completed, the Bell Telephone Company will put in a switchboard and establish an exchange at Mercur.

BILLINGS, MONT.—A telephone exchange will be established here by a stock company which was formed here recently. D. H. Hungerford has been pushing the matter.

NORRISTOWN, PA.—The Norristown & Philadelphia Telephone Company has asked the Norristown Town Council for permission to lay underground wires in the borough.

CHIPPEWA FALLS, WIS.—The new telephone company recently organized in this city, has been granted a franchise by the City Council, to construct and operate telephone lines.

NORFOLK, VA.—The Finance Committee of Council has reported favorably on the application of the American Long-Distance Telephone Company's application, to establish a line in Norfolk.

MILL BANK, S. D.—There is a movement in progress looking toward the establishment of a telephone system in Mill Bank and a line to connect Ortonville, Big Stone City, Simpson and other places.

JOPLIN, MO.—The Missouri & Kansas Telephone Company has decided to build a new system in Joplin, and to extend it to Galena, Webb City and Carthage. An entire new system is to be put in out and out.

EVANSBURG, PA.—At a meeting of the City Council an ordinance was passed granting the District & Printing Telegraph Company the right to erect poles and wires for the purpose of establishing a telephone exchange.

WINNIPEG, MAN.—If the plans of the Bell Telephone are carried out a commodious building will be erected on Thistle Street to cost between $15,000 and $20,000. Plans are now in preparation. Mr. Walsh is the city manager.

HOLLIDAYSBURG, PA.—At a meeting of the Gaysport Council, an ordinance was passed, granting the Altoona Phœnix Telephone Company the right to place the necessary poles and wires on the streets and alleys of the borough.

LAKE ODESSA, MICH.—G. A. Weed, of the Co-operative Telephone Company, has been negotiating with the Lansing Telephone Company and the business men of the city with a view of establishing an independent State line.

PITTSFIELD, MASS.—An ordinance has granted to the Schuylkill Telephone Company the right to occupy the streets and highways of the borough of Pittsfield, with poles and wires, as may be necessary for conducting its business.

WALDOBORO, ME.—The Lincoln & Knox Telegraph & Telephone Company has been organized for the purpose of operating lines of telegraph or telephone. George Bliss is president and Lincoln N. Kennedy treasurer, both of Waldoboro.

ARCHBALD, PA.—A committee of the School Board has been appointed to secure estimates for connecting the high school building with the suburban schools by a telephone system. Messrs. Corcoran, Doolan, O'Rourke and O'Hara are the committee.

BOONTON, N. J.—The ordinance before the Common Council regarding the granting of a franchise to Boonton parties for a new telephone system, has been laid over for a month. A petition has been received from the New York & New Jersey Telephone Company asking for a similar franchise.

PITTSBURG, PA.—The National Standard Company, composed of leading capitalists, which is to compete with the Bell Telephone Company, may build a telephone factory at this place. Col. Conger, of Akron, O.; Gen. Clarkson, of New York, and Gen. McNaught, of Philadelphia, have been in this city to make arrangements for the deal.

PHILADELPHIA, PA.—Selectman Wm. Findley Brown recently introduced in Select Council an ordinance authorizing the mayor to have prepared plans and specifications for the construction of a public telephone system, and to advertise for proposals for the sale of the privilege to construct, maintain and operate the system. No contract is to be entered into, however, until authority is given by ordinance of Council.

RAVENNA, O.—Mr. W. H. Butler, formerly with the General Electric Company, at Schenectady, and now proprietor of the Ravenna & Kent Telephone Exchange, recently gave an exhibition of a telephone of his invention, which a local paper pronounced to be an unqualified success. The transmitter is of the carbon ball type, but with an ingenious adjustment of the balls against the carbon plate, which latter rests upon a rubber gasket. Upward of 60 subscribers now use the Butler instruments at Ravenna and 56 at Kent.

TRINIDAD, COL.—The Citizens' Telephone Company secured an ordinance June 27 for an opposition telephone plant in this city, with rates of $24 and $36 for residence and business places. On October 14 the City Council revised its ordinance to conform in part to the desires of the Colorado Automatic Telephone Company, of Colorado Springs, Col., who will immediately begin the construction of a Strowger automatic telephone exchange at that point. Among other changes the rates were made $30 and $40. This Strowger exchange will, excepting a small plant placed on the Portland Gold Mining property, at Victor, Col., be the first of the kind in the West.

ELECTRIC LIGHT AND POWER.

BRONSON, MICH.—The citizens of Bronson have voted to light the town with electricity.

MOWEAUQUA, ILL.—Moweaqua is discussing the question of lighting the city by electricity.

BRUNSWICK, MO.—The city has voted to issue $15,000 in bonds for waterworks and an electric plant.

CHICO, CAL.—The City Trustees will hold a meeting at which the matter of an electric light plant will be discussed.

UNIONVILLE, O.—Unionville will shortly vote on the proposition to bond the city for a water and electric light plant.

BRANFORD, CONN.—Branford and Guilford are to be supplied with electric lights by the Branford Electric Company.

SPRINGFIELD, O.—The City Clerk has been instructed to advertise for bids for 150 electric arc lights, each of 2,000 cp.

NEW BERLIN, N. Y.—The electric plant has been burned. Loss, $15,000, the building and machinery being totally destroyed.

MADISON, IND.—The Council is discussing the matter of securing electric lights at a cheaper rate. The city now owns the plant.

SCOTTDALE, PA.—There is some talk of the borough erecting its own electric light plant. Burgess Robertson may be addressed.

MONTE VIDEO, MINN.—A franchise has been granted to the Monte Video Roller Mills allowing them to put in an electric light plant.

POCANTICO HILLS, N. Y.—John D. Rockefeller, 26 Broadway, New York City, will build a chateau, which will be lighted by electricity.

HONESDALE, PA.—Ground has been broken for the enlargement of the plant of the Honesdale Electric Light, Heat & Power Company.

TAMPA, FLA.—The City Council is taking steps toward the lighting of the city with electricity or gas. President Moore may be addressed.

MONTPELIER, VT.—The Electric Light Committee of the City Council is receiving bids for an additional dynamo of a capacity of 1,000 lights.

PESHTIGO, WIS.—The Peshtigo Lumber Company will add an electric plant to its mills, which will be used in lighting its machine shops, etc.

NEW CASTLE, DEL.—A proposition to light the streets of New Castle by electricity has been referred by the City Council to the light committee.

ROCKFORD, ILL.—The City Council has closed a deal for the purchase of property, with water power, on which a 400-light arc lighting plant will be erected.

SHEEPSHEAD BAY, L. I., N. Y.—The Nassau Electric Railway Company has made overtures to the Taxpayers' Association, concerning the lighting of the old town of Gravesend.

BEATRICE, NEB.—The lighting committee has been authorized to advertise for bids for lighting the city by electricity for two, three or four years. Edward Hays, city clerk, can furnish particulars.

RICHWOOD, O.—Richwood will vote on the proposition to bond the town for $7,000 to build a lighting plant. George K. Smith, of Columbus, is working up the matter.

SAN FRANCISCO, CAL.—Park Commissioners are considering the question of lighting the park by electricity. It is estimated that a suitable plant can be purchased for $10,000.

YOUNGSTOWN, O.—A franchise has been granted to Henry F. Kaircher to erect and maintain necessary poles and wires, for the purpose of operating an electric light system.

NEWARK, O.—The Citizens' Electric Light Company, of which Mr. Fred Taffel is superintendent, will install Westinghouse machinery for 5,000 incandescents, and a 300-hp Cooper-Corliss engine.

COLUMBUS, TENN.—An electric light plant is contemplated. It will comprise a new engine, 70 to 100-hp, one arc dynamo of 50 to 75 lights capacity, and an incandescent dynamo of 650 lights capacity.

BALTIMORE, MD.—At a meeting of the Park Board, the principal matter discussed was Mayor Latrobe's proposition to establish an independent electric lighting plant for Druid Hill Park, at an estimated cost of $20,000.

SENECA FALLS, N. Y.—Work has been begun on the electric power-house at Cayuga Lake Park. The building is to be equipped with machinery of sufficient power to operate a portion of the electric railway, as well as the lights in the park.

PHILADELPHIA, PA.—Permission has been granted to the Pennsylvania Light, Heat & Power Company, by the Committee of the Board of Highway Supervisors, to proceed at once with the laying of conduits along various streets, from Twentieth Street to the Delaware River.

UPPER ALTON, ILL.—The President and Board of Trustees of Upper Alton will, November 4, receive bids in writing for a franchise to erect and maintain a water works and electric light plant, according to plans and specifications adopted by the Board. P. S. Webster is village clerk.

PINE BLUFF, ARK.—At a recent meeting of the City Council a committee of four aldermen was appointed to correspond with parties interested, with a view to the establishment of an electric street railway and a city lighting plant. The committee invites correspondence, communications to be addressed Charles Weyl, chairman of the committee.

HACKENSACK, N. J.—Proposals for lighting the town of Hackensack by gas or electricity for the period of one or three years will be received at Commission Hall, Mercer Street, until 8 p. m., Oct. 28. Bids for lighting by electricity will be for 32-cp incandescent lights and also for 15 or more arc lights. C. E. Eckerson and John Shafer are the Light Committee.

JAMESTOWN, N. Y.—The Board of Public Works has recommended that the city purchase and install one 2,000-light multiphase alternator and one 50-light arc machine, with necessary pulleys, belts and foundations. Pres. Hull, of the Common Council; John Conway, E. O. Jones and Samuel J. Carlson, of the Board of Public Works, are the officials in charge of the movement.

SEATTLE, WASH.—The alliance between the Seattle Gas & Electric Lighting Company and the Union Electric Company has been dissolved. The former company will re-enter the field for business, the holders of its securities having determined to advance the necessary capital to make extensive improvements and extensions of its plant. Charles N. Hamblin, of Minneapolis, has been in this city for several days investigating the requirements of the plant. New machinery will be added, mains extended and enlarged at the cost of from $40,000 to $50,000.

THE ELECTRIC RAILWAY.

BRADFORD, MASS.—Surveyors are at work on Salem street for H. D. & G. Street Railway.

AUBURN, N. Y.—The G. W. S. F. & C. L. Traction Company will construct a new power house at Cayuga Lake.

CHICAGO, ILL.—The stockholders of the Alley "L" road favor putting down surface lines, as feeders to the elevated line.

WATERLOO, IA.—A company has been incorporated for the construction of electric street lines in Waterloo and Cedar Falls.

TITUSVILLE, PA.—Leading citizens of Titusville have petitioned the councils of that city to build an electric street railway.

MEADVILLE, PA.—The Meadville City Council has given a franchise to a company which agrees to build and operate motor cars.

BANGOR, ME.—A petition is being circulated by the Street Railway Company asking that it be allowed to lay a double track in Main Street.

ASHLAND, PA.—A charter has been granted to the Mahaney Valley Street Railway Company to operate a line between Ashland and Cordon, Schuylkill County.

ELIZABETH, N. J.—A syndicate has been looking over the turnpike road from Elizabeth to Summit, with a view to building a trolley line between the two places.

CHICAGO, ILL.—The West Chicago Railway Company has secured a franchise for an electric street line on Western Avenue, between Belmont and Milwaukee Avenues.

LITTLE FALLS, N. Y.—C. L. Pyloe, president of the Little Falls & Richfield Spring Electric Railway, is in the city to make arrangements to begin the construction of a line.

GREENSBURG, PA.—Judge Sadler, of Carlisle, is at the head of a company of capitalists, who are building an electric road from Greensburg to Wilmerding, a distance of 20 miles.

KENSINGTON, D. C.—Several improvements on the electric road between Kensington and Washington are projected. A new station and car-house will be erected at Kensington.

AVALON, PA.—The Borough Council has passed an ordinance granting the Pleasant Valley Company the right of way over the New Brighton road, as far as the Avon Borough line.

ARCHBALD, PA.—An ordinance has been passed authorizing the Archbald Street Railway Company to lay its tracks and operate its road, on the streets within the borough limits.

EAST ROXFORD, MASS.—The town of East Roxford has subscribed $3,000 worth of stock in the Haverhill, Georgetown & Danvers electric road, providing it will extend through the village.

WATERLOO, N. Y.—New power-house and car-houses are to be built on the site of the old Bogart apple orchard. The company has decided to make Waterloo the headquarters of the line.

BENNINGTON, VT.—The Bennington & Rutland Railway Company is considering the advisability of operating a five-mile branch between Bennington and North Bennington by electricity.

LAUREL, MD.—At a meeting of the City Council the Maryland & Columbia Railway Company was granted permission for the construction and operation of an electric railway upon certain terms.

FAIR HAVEN, MASS.—It is thought that the work on the power station will be commenced next week. The building will be of brick, 32 x 22, and will be located on Water Street, south of Union.

CORTLANDT, N. Y.—At a meeting of the Board of Trustees the Cortlandt & Homer Traction Company was granted an additional franchise for a track along Elm Street, from Church Street to Pendleton.

NEW HAVEN, CONN.—Vice-President Hall, of the Consolidated road, has stated that the Stamford & New Canaan branch, recently purchased and about eight miles in length, will be equipped with electricity.

NEW PHILADELPHIA, O.—The commissioners of Tuscarawas County have again advertised for proposals for a franchise for the construction of an electric railway between New Philadelphia and the twin cities.

BEVERLY, MASS.—The Lynn & Boston Street Railway Company has received permission from the Beverly aldermen to overhaul the tracks of the old Beverly & Danvers road and equip it for electric traction.

PAINESVILLE, O.—The Commissioners have granted a franchise to the Cleveland, Painesville & Eastern Railway Company, on conditions that the road be completed and operated by electricity within one year.

HARTFORD, CONN.—At a meeting of the Street Board, Albert W. Gilbert was re-engaged to attend to the city's interest in the new street railway extension, which enbraces the line through New Britain Avenue, to the city limits.

URBANA, O.—W. H. Hanford & Company, who were recently granted a franchise to operate an electric street railway over certain streets of the city, have left with the city solicitor a written acceptance of the conditions of the franchise.

NEW BRITAIN, CONN.—It is understood that the Street Committee has decided to grant the Central Railway & Electric Company permission to change its tracks and make such other improvements as asked for in its petition to the Common Council.

RICHFIELD SPRINGS, N. Y.—A charter election of the village of Richfield Springs was held Oct. 8. to determine the fate of the Little Falls & Richfield Springs electric road; John Guyer was elected vice-president. A new application will be made for a franchise.

BANGOR, ME.—At a meeting of the City government, the petition of the Bangor, Orono & Oldtown Railway Company, for locating its railway on certain streets, was referred to a special committee of the Board, with the City Engineer and Aldermen Grant, Porter and Glass as members.

WASHINGTON, PA.—The Washington & Canonsburg Railway Company, has been chartered to construct a line of seven miles from Washington to Canonsburg, Washington County. The capital is $75,000, and the directors are A. Kennedy, of Allegheny; Francis J. Formuer, Thomas B. Hutchinson, L. H. Matthews, Wm. Beall and Marshall H. Reno.

OWASSO, MICH.—J. Henry Edmonds, of Cape May, N. J., and Alexander Ralph, of Philadelphia, Pa., have been in the city, perfecting plans for putting in electrical equipment on the Owasso & Corunna street railway. They appeared before the Council, and asked further grants. A plant will probably soon be in operation, at an outlay of $30,000.

HAGERSTOWN, MD.—The City Council passed an ordinance on Oct. 7, authorizing the Hagerstown & Potomac Street Railway Company to construct a street railway in Hagerstown. A special meeting of the council was also held, to consider a franchise for a street railway for C. K. Kindred and Z. P. Boyers, and others, comprising a Philadelphia syndicate.

ELYRIA, O.—The City Council has unanimously decided to grant a franchise to James A. Mauldin, representing Cleveland capitalists, to construct an electric railway through this city, beginning at the southern limits. It will be extended to Lorain and North Amherst, making the second line to connect Elyria and Lorain. Work on the line is to begin at once.

ST. LOUIS, MO.—J. T. Houseman, the projector of the House & Air Line otherwise known as the Daumhoff electric line, to the Merrimac Highlands, now announces that he will build another and longer road in St. Louis County. This will be a branch of the air line, and will start from the power-house at Brentwood, and extend westward to Pacific, Mo., a distance of 40 miles.

WORCESTER, MASS.—At a regular meeting of the directors of the Consolidated Street Railway Company it was voted to petition the city government for authority to extend the tracks at Newton Square, 2,000 feet farther west over Pleasant Street. Heavy girder rails will be laid. The company will also extend the tracks at Quinsigamond Village farther over Greenwood Street.

ONEIDA, N. Y.—The formation of the Central New York Light & Power Company has revived the question of constructing an electric railway from Oneida to Sylvan Beach on Oneida Lake. The new company has been consolidated with the old Warner Electric Light Company, the capital stock of the new concern being $100,000. John W. Warner, Oneida; A. M. Young, Waterbury, Conn., and others are interested.

LANGHORNE, PA.—A new company, to be known as the Langhorne, Bristol & Newtown Trolley Company, recently formed at Langhorne, has obtained a charter, and work will be begun at once. The distance between Langhorne

and Bristol is seven miles, and on the proposed route there are six towns—Langhorne, Langhorne Manor, Eden, Hulmeville, Newportville and Bristol. At the latter place, the line will connect with the proposed Philadelphia and New York trolley railway.

MISCELLANEOUS.

THE NEW YORK ELECTRICAL SOCIETY will hold its next meeting at Columbia College on Monday evening, Oct. 28, when Mr. P. B. Delany will lecture on "High Speed Commercial Telegraphy."

THE MISSISSIPPI STATE COLLEGE, of Starkville, will soon have a large and thoroughly equipped electrical and mechanical laboratory, an appropriation for that purpose having been made by the State legislature.

THE BROOKLYN ELECTRICAL SOCIETY, at a meeting held on Oct. 15, adopted resolutions of regret upon the death of Franklin L. Pope, in which his great services to the science and industry of electricity are fittingly set forth.

THE HENRY ELECTRICAL CLUB.—On Friday, Oct. 25, Mr. Geo. F. Sever, instructor in electrical engineering at Columbia College, will deliver a popular lecture before the Henry Club, on the compound-wound dynamos. On Friday, Nov. 1, Prof. M. I. Pupin, of Columbia College, will give a discourse on alternators. These lectures are held at the American Institute of the City of New York, 111–115 West Thirty-Eighth Street, and everybody interested is cordiallly invited to attend.

Trade and Industrial Notes.

THE ELECTRIC SUPPLY & MANUFACTURING COMPANY, of Cleveland, O., announces the voluntary retirement of Mr. C. H. Estinghausen from that firm. The business will be conducted as usual from the same stand under the management of Mr. H. Whitford Jones.

THE AMERICAN LIGHT & REFLECTOR COMPANY is supplying the Pabst Milwaukee Theatre with its well-known compartment deflectors and border lights. Contracts are also on hand for Atlanta, Ga.; Anderson, Ia., and St. Marys, Ohio. The company has just brought out a novelty in the shape of an orchestra shade, which is meeting with great success.

JULIUS ANDRAE & SON'S COMPANY, Milwaukee, have taken a general sales agency for Buckeye lamps, which will be vigorously pushed in its territory. The same company has issued a well-illustrated, 16-page catalogue of Andrae telephones and telephonic supplies and accessories, the latter including a compact and handsome switchboard. A number of patterns of telephones are shown, all of which present a pleasing mechanical appearance.

THE HORN & BRANNEN MANUFACTURING COMPANY, Philadelphia, whose factory was recently destroyed by fire, made a fine display of energy and executive skill by getting its foundry into operation within two days after the fire, and within ten days started up regularly again with the manufacture of electrical fixtures. That such magnificent ability is recognized is plainly demonstrated by the fact that the company has now orders ahead sufficient to keep the factory running full time until January.

MR. JAMES G. BIDDLE, sales agent of the Weston Electrical Instrument Company, has issued a handsome catalogue of the Weston instruments. The various types of ammeters, voltmeters and wattmeters are illustrated by well-executed wood cuts, and a full list given, with telegraph code numbers, of the very numerous instruments made. A portion of the pamphlet that will be highly appreciated is that containing a reprint from our columns of the articles by Dr. Maschke on the employment of Weston instruments in the measurement of resistances, industrial testing, etc.

THE AMERICAN BLOWER COMPANY, on Oct. 12, succeeded to the interests of the Huyett & Smith Manufacturing Company of Detroit, Mich. The personnel remains the same, with the exception of the withdrawal of Mr. W. D. Smith, vice-president. Mr. Huyett not having been connected with the company for more than ten years, the necessity of a change was obvious. Under the new firm name the company will endeavor to maintain the advanced position it has always held in the manufacture of hot blast apparatus, dry kilns, fans, blowers, engines, and all kindred machinery. The present officers are D. M. Ferry, president, A. E. F. White, vice-president, and James Inglis, secretary and treasurer.

CEDAR LINE POLES.—W. C. Sterling & Son, of Monroe, Mich., received their fourth large cedar raft from the North. This has been a very busy year for this firm, and they have handled thousands of car-load of street railway electric light and telephone poles. In the last year they have shipped one consignment to Buenos Ayres, South America, and many to the Mexican border as well as Canada. They now have piled at their five cedar yards many thousand cedar poles ready for the coming year's trade, having sorted out each length and size so as to make good dispatch. Their Monroe yard is the largest Southern yard in this country, and being situated on several railways enables prompt shipments to be made.

THE PROOF OF THE PUDDING IS IN THE EATING is the title of an effective circular of the Aultman & Taylor Machinery Company, of Mansfield, O., giving a list of some of the most noted manufacturing concerns in the United States using the Cahall vertical water tube safety boiler, with the query, that if it is good policy for these firms to use the Cahall boiler, why would not the same be true of the reader? The following sales within the past ten days by H. E. Collins & Company, Pittsburg, Pa., sole sales agents for the boiler, indicate the strength of this argument: Mahoning Valley Iron Company, Youngstown, O. (third order), 300 hp; Sharon Iron Company, Sharon, Pa., 500 hp (second order); Phœnix Glass Company, Pittsburg, 75 hp; Citizens' Gas Company, Bridgeport, Conn., 330 hp; Isaac Harter Milling Company, Fostoria, O., 500 hp; Hainsworth Steel Company, Pittsburg, 500 hp

THE ACME FILTER COMPANY, 700 North Main Street, St. Louis, Mo., reports an active demand for its filters and the following recent sales: The Southern Cotton Oil Company, one each for its plants at Houston, Tex.; Atlanta, Ga.; Montgomery, Ala.; Little Rock, Ark.; New Orleans, La.; Columbia, S. C., and Memphis, Tenn.; North Carolina Cotton Oil Company, S. & W. H. Northrop, Wilmington Cotton Mills and Peregoy Lumber Company, of Wilmington, N. C.; Columbia Incandescent Lamp Company, St. Louis; Standard Oil Company, Cincinnati, O.; English Supply & Engine Company, Kansas City, Mo.; John H. Richardson, Barcelona, Spain; City Water Works, Manchester, Va; Vacuum Oil Company, Boston, Mass.; Lewis Rice, Philadelphia, Pa.; H. N. Bates Machine Company, Boston, Mass.; Leonard & Ellis, St. Louis, Mo., and Cincinnati Butchers' Supply Company, Cincinnati, O.

MR. J. D. LEATHERBEE, treasurer of the National Telephone Manufacturing Company, of Boston, left on Oct. 17, for Mobile, Ala., on business connected with the installation of the National system for the Home Telephone Company, of that city, which, it is said, will be the largest independent telephone installation ever made, and over which Mr. Leatherbee feels justly proud, as the National system was adopted after almost rigid examination which included also all other systems. It is understood that the Home Telephone Company will commence business with an unexpectedly large list of subscribers, to accommodate which the size of the switchboard has been twice increased, the order for the last section being only received a few days ago. This installation is being made under the personal supervision of Mr. Arthur F. Boardman, electrician of the National Company, who has been in Mobile already some two weeks.

Business Notices.

ELECTRIC LEAGUE.—Meets every Thursday evening, 100 West 24th Street, New York. Electrical engineers and electricians cordially invited.

BATTERY CUT-OUT CHEAP.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, of 15 South Warren Street, Syracuse, N. Y.

THE SETH THOMAS CLOCK COMPANY, of Thomaston, Conn., has for a number of years done a great deal of work for electrical companies, and would be glad to increase this line of business. They will make estimates for any article akin to clockwork, for which a model is furnished and which is wanted in quantities. Address, Seth Thomas Clock Co., 49 Maiden Lane, New York.

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED OCT. 15, 1895

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York City.]

547,783 and 547,784. SUPPLY SYSTEM FOR ELECTRIC RAILWAYS; J. Hartman, Philadelphia, Pa. Filed April 7, 1893. The combination of a continuous conduit provided with parallel trolley grooves, the latter having therein the lead and return conductors respectively, each also having on each side a metallic protecting strip and being insulated from the other and from the sides of the grooves.

547,820. STAFF APPARATUS FOR WORKING SINGLE LINE RAILWAYS; I. A. Timmis, London, Eng. App. filed Dec. 1, 1893. The combination of two similar staff instruments connected together by a line wire, each having a plunger, electrically controlled plunger-locking mechanism and a switch actuated upon inserting a staff into either instrument, and operating to release the plunger of one instrument from its said locking instrument.

547,825. COMBINATION CIRCUIT CLOSER AND SPRINKLER; G. A. Wall, Providence, R. I. App. filed Feb. 11, 1895. The combination of a sprinkler having a member held by fusible solder, a thermostat whose moving member is also held by solder out of contact with the metal of the sprinkler and a mechanical connection secured at its inner end to the moving end of the sprinkler, and carrying at its outer end the solder of the thermostat, whereby the solder of the thermostat is freed from the causes which tend to prevent the rise of temperature of the solder of the sprinkler.

547,834. ELECTRICAL TRANSMISSION OF POWER; W. D. Baldwin, Yonkers, N. Y. App. filed July 3, 1894. The combination of a working motor and car connected to be operated thereby, a motor generator to drive the working motor, the armature shaft of the working generator being mounted to rotate freely under the action of momentum after the circuit is cut off, and a switch on the car controlling the current through the motor and field magnets of the generator.

547,835. ELECTRIC CAR LIGHTING APPARATUS; W. Biddle, Brooklyn, N. Y. App. filed Jan. 16, 1895. The combination of a dynamo, an armature with two or more sets of commutator plates or brushes, the coils of the armature being connected to the respective plates, and mechanism for separating one or more of the brushes to throw out of action one or more of the coils of the armature, an armature carrying a brush and an electromagnet for moving the same, the helix of such electromagnet being in circuit between the brushes.

547,847. COMBINED ELECTRICAL AND MECHANICAL BRAKE; James R. Cravath, of Chicago, Ill. The combination of an electrical brake, the function of which is to exert the initial retarding effect, with a mechanical brake which serves to bring the car to a dead stop and hold it stationary, the two mechanisms being operated by a single lever.

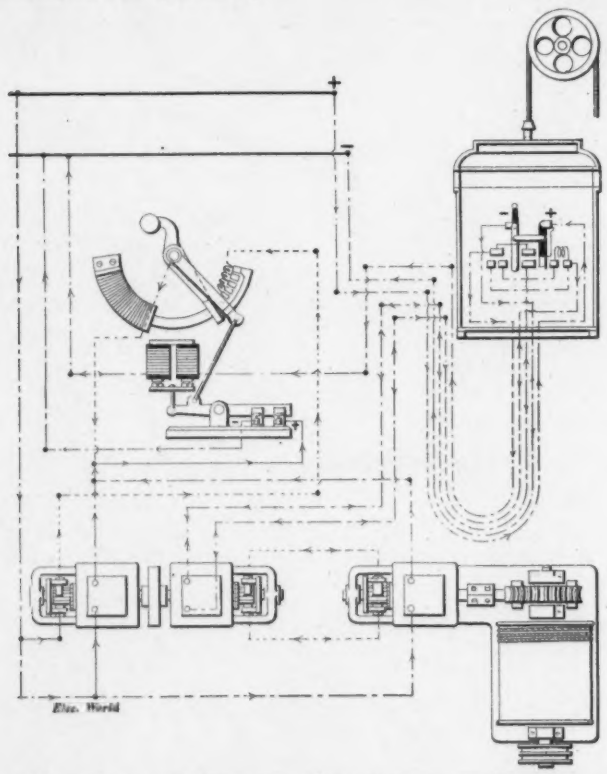
547,873. SWITCH OR CROSSOVER SYSTEM FOR ELECTRIC RAILWAYS; H. M. Brinckerhoff, Chicago, Ill. App. filed June 13, 1895. The combination of a railway having two or more tracks, each provided with a conductor, a switch track comprising a stationary and a movable track section, with independent connections for the same, one or more sections being movable to gauge with said stationary and movable sections.

547,897. ELECTRICAL SUCCESSION SIGNALLING SYSTEM; James G. Smith, of New York, assignor of one half to Robert G. Vassar, of the same place. In a signalling system having a plurality of stations, two wires running in opposite directions through the said stations, one of the wires having electrical instruments connected with it, these instruments having individual circuits at the said stations leading from the said wire to the other wire, having electrical devices to effect the breaking of the individual circuits at one station to permit the current to pass to the instrument at the next station, and means connected with the opposite portion of the said wire for operating the circuit-breaking devices.

547,900. FIRE ALARM; E. A. Speer, Toledo, O. App. filed May 23, 1895. The combination of a transmitting instrument, a magnet, a detent controlling a drop and arranged to actuate an escapement, a spring adapted by its rebound to relieve the escapement from the weight of the drop, and a second magnet, also adapted to actuate the said escapement.

547,914. SERIES ELECTRIC RAILWAY; O. B. Finn, Philadelphia, Pa. App. filed March 29, 1894. The combination of a moving vehicle carrying a conductor supported laterally thereon, a single main line having contact mechanisms situated at intervals and provided with wheel-carrying devices to engage with the conductor on the vehicle, and train-operating devices for locking and releasing the arms.

547,931. INSULATOR FOR TROLLEY WIRE SUPPORTER; J. W. Meaker, Evanston, Ill. App. filed Nov. 19, 1894. The combination of a shell and a bolt adapted to fit therein, having a cap fitting over it, a wire and a clamp for securing the wire upon the cap.



No. 547,834.—Electrical Transmission of Power.

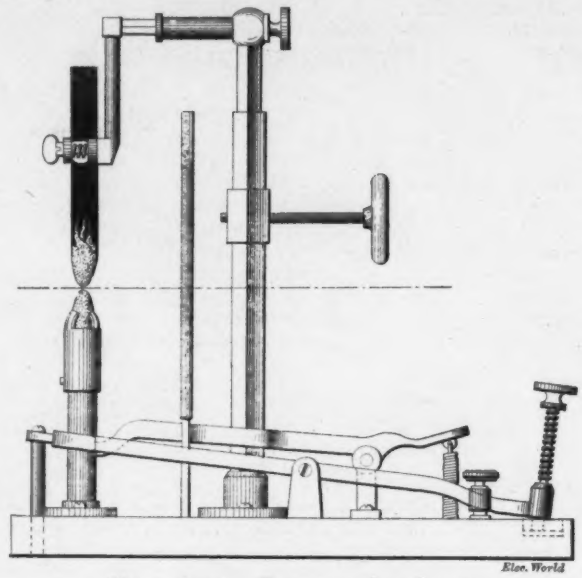
547,942. ELECTRICAL SUCCESSION SIGNALING OR CALLING SYSTEM; J. G. Smith, New York, N. Y. App. filed Jan. 14, 1895. A signaling system consisting of three line wires, an electrical instrument connected with one of the wires, a spur therefrom and a circuit-breaker for the spur wire, another of the wires having a magnet, devices for operating the circuit-breaker operated by the magnet, and a shunt around the magnet, the other of which line wires has a magnet to break the shunt.

517,960. TELEPHONE SYSTEM AND CABLE; J. W. Marsh, Pittsburg, Pa. App. filed May 6, 1895. A telephone system having a cable inclosing a bunch of direct wires and one or more metallic returns for said wires, each common metallic return consisting of one or more pairs of wires insulated and twisted together for use as one or more complete metallic telephone circuits.

547,979. ELECTRIC HEATER; G. H. Whittingham, Baltimore, Md. App. filed July 15, 1895. A heater consisting of a resistance wire extending through a pipe, a heat-conducting medium completely surrounding the resistance wire and filling the pipe, a binding post and a cap and means for sustaining the resistance wire.

548,027. TELEPHONE ATTACHMENT; C. H. Bernhard, Cleveland, O. App. filed March 15, 1894. An elastic body such as a cord adapted to be connected with the telephone switch and the receiver cord, thereby keeping the switch in electrical contact.

548,028. ELECTRIC ARC LAMP; C. Beseler, Jersey City, N. J. App. filed May 4, 1895. An arc lamp having a base fulcrumed to carry the lamp with a lever thereon, and having pins to rest on a fixed part of the magic lantern, the other end of the lever being provided with a screw resting in a step in the base, so that when the screw is turned an inclined position is given to the base.



No. 548,028.—Electric Arc Lamp.

548,032; SUPPLY SYSTEM FOR ELECTRIC RAILWAYS; H. V. Brown, Brooklyn, N. Y. App filed Nov. 21, 1894. The combination of a series of shiftable current carriers, catches therefor, shunt circuits adapted to throw the catches electrically, and switches in the shunt circuits adapted to be actuated by the current carriers.

548,036. INCANDESCENT ELECTRIC LAMP; S. E. Cox, Cleveland, O. App. filed July 18, 1895. The combination of a lamp having channels or recesses in its neck, a metallic sleeve on the neck and sealing material between the sleeve and the neck of the bulb; it also entering the channels and recesses.

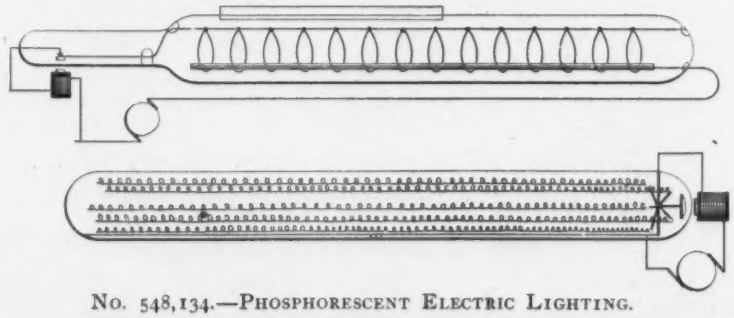
548,038. THERMO-ELECTRIC GENERATOR; H. B. Cox, Hartford, Conn. App. filed Jan. 31, 1894. A method of making thermo-electric couples which consists in forming a thin, hard metal strip element, and comparatively large metal element of a lower fusing point than the strip element, then passing an electric current through said large soft metal element and thin metal strip which are properly proportioned so that the hard metal fuses to the soft metal to form the alloy of the metals of both parts and unite them by graduated alloy junction.

548,070. ELECTRIC RAILWAY SYSTEM; J. La Burt, Brooklyn, N. Y. App. filed June 26, 1894. The combination of a track, contact line and a main conductor, rock levers having arms carrying contact plates extending therefrom and adapted to engage with the contact pieces which have connection with the main conductor.

548,074. TROLLEY ROPE AND POLE CONTROLLER; C. A. Lord, San Francisco, Cal. App. filed Jan. 9, 1893. The combination of a trolley pole and a trolley rope connected to a car at one end and passing over the end of the pole, a tension device controlling the said rope, and an automatic lock for locking the device when the trolley leaves the conductor.

548,126, filed Oct. 13, 1894; 548,127, filed July 19, 1895; 548,128, filed April 10, 1895; 548,129, filed Dec. 4, 1894; 548,130, filed Jan. 3, 1895; 548,131, filed Jan. 7, 1895; 548,132, filed Jan. 9, 1895; 548,133, filed Jan. 24, 1895; and 548,134, filed Jan. 25, 1895. ELECTRICAL ILLUMINATION BY PHOSPHORESCENT FLAME; D. McF. Moore, New York, N. Y. An electric phosphorescent flame producer consisting of an evacuated inclosure, movable terminals of an electric circuit therein, and electric conductors of similar polarity connected to one of the terminals and extending through the evacuated space and in loose contact with each other at points.

548,161. INTERLOCKING SIGNALING APPARATUS; C. Hansel, Easton, Pa. App. filed March 5, 1895. The combination of levers and tappets and a bolt engaging an opening in one of the tappets, and a mechanical connection between the said bolt and the door of the signal-tower.



No. 548,134.—Phosphorescent Electric Lighting.

548,162. COMBINED DIAPHRAGM AND ELECTRODE; J. Hargreaves and T. Bird, Liverpool, Eng. App. filed Dec. 31, 1894. A combined porous diaphragm and permeable electrode, consisting of a perforated metal base having directly secured to one face a mixture of fibrous material and an insoluble binding agent.